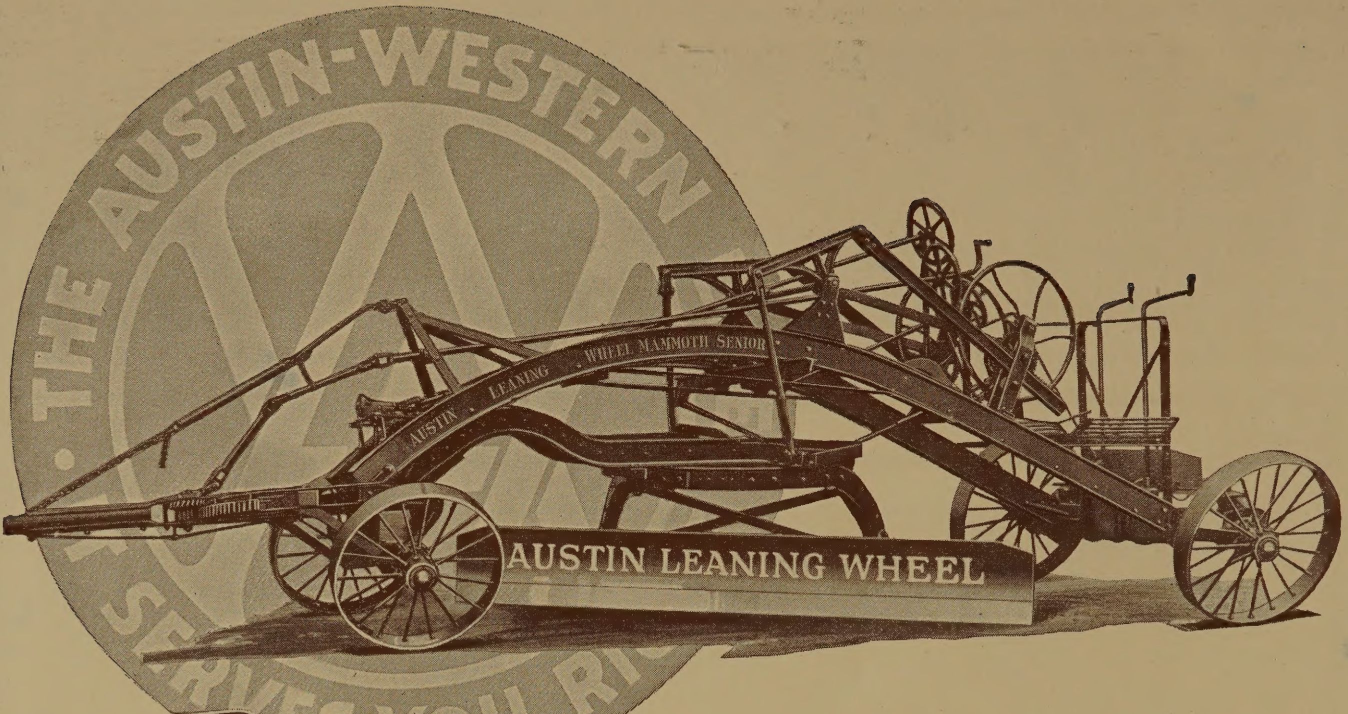
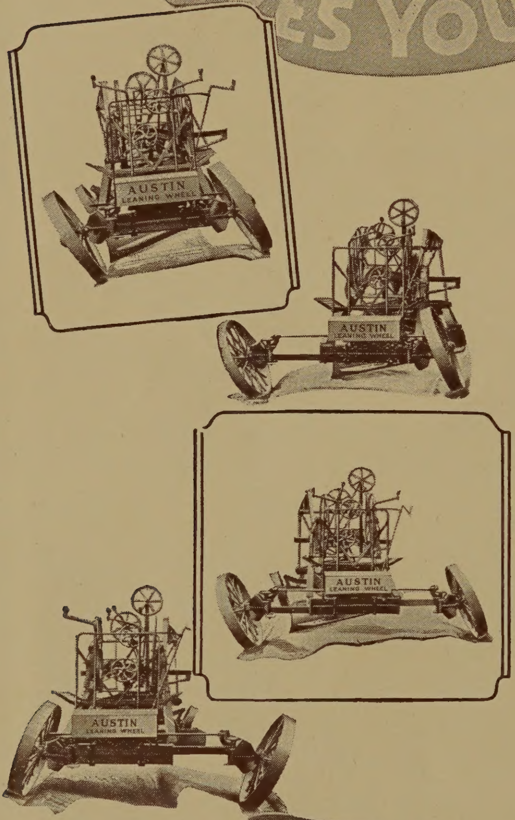
North Carolina Highway Bulletin

VOL. 5 DECEMBER NO. 10

A BEAUTIFUL APPROACH TO A NORTH CAROLINA TOWN





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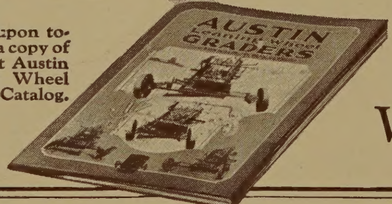

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NORTH CAROLINA HIGHWAY BULLETIN

VOL. V NO. 10 **H. K. WITHERSPOON, Editor** **DECEMBER, 1924**

State Police *and* Highway Patrols

Sixteen states now have motorcycle police patrolling highways—Pennsylvania, New York and Massachusetts corps found efficient and effective

By Bert Q. Tilley

SINCE the days of the old Pennsylvania State Constabulary, interest has been centered around them, rather than the North West Mounted Police of Canada, whose operations were too far off to bring home a full realization of their wonderful work and many hardships.

From the inception of the Pennsylvania organization, they have been watched carefully by not only those opposed to its establishment in the state, but also by the officials of every other state, who saw the possibilities, but who were "from Missouri," in so far as wanting to be shown was concerned.

Throughout the long years of state police work, nothing but the highest kind of praise has been given by the press of the country, and by organized labor, who at first were under the impression that this state force was purely military, to be used against strikes and therefore opposed its organization strongly.

It took but a short time for other states to realize the value of such a force, and one by one, they have fallen in line until today, there are sixteen state police and highway patrols doing valiant duty throughout the country, with legislative activity in other states.

When the first state police organizations were formed, the automobile was in its infancy, good roads few, and highway congestion outside of the large cities, practically unknown. The rapid expansion of the automobile business, and good roads everywhere, developed speed maniacs, drunken drivers, and the advent of the crooks of all classes covering the highways in high-power

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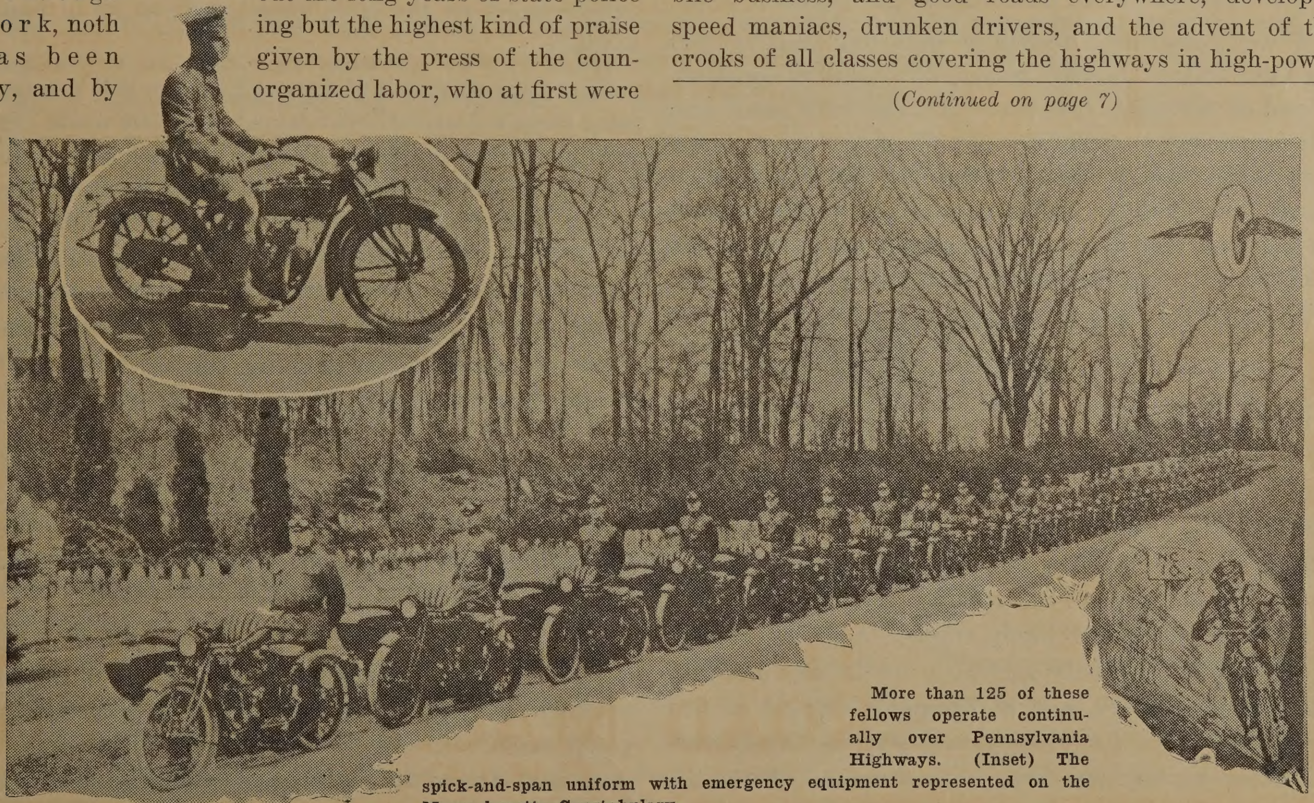

More than 125 of these fellows operate continually over Pennsylvania Highways. (Inset) The spick-and-span uniform with emergency equipment represented on the Massachusetts Constabulary.

Economic Selection *of* Road Building Materials

By W. E. Hawkins, *State Maintenance Engineer, North Carolina*

As materials are the fundamental parts of any highway construction, it is essential that their selection be given serious consideration in any contemplated highway program.

All states are limited in their appropriations for highway construction and it is therefore necessary that a connected system of roads be made available within a reasonable time that will adequately carry traffic at a minimum of operation costs. Each state has its highway developed sections where traffic necessitates the construction of a high type road, while in the rural and remote sections a less expensive road will serve the requirements of traffic for many years.

For all types of construction the same standard for line, grade and drainage structures should be used. By this plan of progressive construction a graded road can be utilized until the increased traffic creates a high cost of maintenance, then the next step is to cover the surface with a selected soil material, such as topsoil, sand-clay or gravel. This selected surface material can be maintained until such time the maintenance cost becomes excessive and the increased traffic indicates that a hard surface road is necessary. By this method all previous construction is utilized and each step may be considered as a foundation for the next higher type surface.

A well constructed topsoil or sand-clay road is ideal for light traffic. It requires very little skill to construct a road of this type. The material comes from many pits adjacent to the road which makes the cost of construction reasonable. An experienced inspector can easily detect the varying qualities of the material, and so distribute it on the road that in time with suitable maintenance the surface eventually becomes smooth and uniform. Topsoil or sand-clay is a great asset to numerous states, as many miles of this type are constructed affording a connected system of highways at a minimum cost.

Similar to topsoil, a gravel road is generally constructed of local material. Gravel for road building purposes should contain from 10 to 15 per cent of loam or clay. Deposits are generally found adjacent to the road or within economic hauling distance. The material when properly selected will bond together and form a surface satisfactory for rather heavy traffic. A gravel road is easy to repair and if the surface is continually dragged, whether wet or dry, and a reasonable amount of fine loose material kept continually scattered uniformly over the entire surface the cost of maintenance will be reduced to a minimum.

There are many states in which selected soil material of this character can be found, while in others many deposits of coarse aggregate and fine aggregate can be located.

The problem of the engineer is therefore to select a type of construction that will utilize to the best advantage any available local material.

To secure the most economical construction on any proposed work, investigation should be made to determine if satisfactory local material is available. Material survey parties should be sent into the field to locate all local materials which could be used advantageously in the construction work. In this way local deposits of material will be found that will afford an economic selection of material and a type of road constructed that will meet the requirements of the local community for many years.

Recent experiments in some states where sand is the only available local material, and freight rates prohibit the use of imported material, have demonstrated that an economical pavement can be constructed of sand and asphalt. If sand can be found in sufficient quantities which approximate a sheet asphalt grading a pavement can be constructed at a low cost which will meet traffic requirements on the main routes, as well as in remote sections.

There are a number of states which are still constructing a large mileage of water-bound macadam roads. They are justified in building this type of road as it enables them to utilize the local material to the best advantage. It is generally admitted that the ordinary macadam road is not well suited to any considerable amount of automobile traffic, but when a bituminous treatment is applied to the surface the roadway may be satisfactorily maintained for moderate traffic. In certain localities a large mileage of penetration macadam is being constructed, as local stone can be obtained at a very low cost. This pavement is laid upon a well compacted broken stone or gravel base, and if properly constructed will successfully carry relatively heavy traffic. By the use of local materials and the low cost of construction many miles of this type of pavement are constructed annually.

In some sections of the country local deposits of feldspar, chert, and shale are being utilized in the construction of roads of a similar nature in communities which might not have had the benefit of highway improvement due to the high cost of importing materials.

(Continued on page 10)

Development *of* Sand Asphalt *in* North Carolina

By H. C. WEATHERS, *Construction Engineer*

BEFORE going into the development of Sand Asphalt pavement in the State of North Carolina, I wish to give a brief description of this type of pavement.

Sand Asphalt pavement is a Bituminous Mixture constructed in two courses, consisting of a 3 inch compacted base course and a 1 1-2 inch compacted wearing surface course. The base course mixture is composed of about 7% asphaltic cement and 93% local sand. The wearing surface is a sheet asphalt mixture. Penetration of asphaltic cement, is approximately 40.

The development of the sand asphalt type of pavement is a story of adaption to local conditions and utilization of local materials to produce a year round serviceable road at a reasonable expenditure of money.

Eastern North Carolina is sparsely populated and contains a number of small towns, scattered here and there with large undeveloped sections in between. At the beginning of the present road building program there were practically no roads worthy of the name in eastern North Carolina. To facilitate the growth of this section of the State, it was necessary to construct a main system of good roads connecting the cities and towns and traversing this unpopulated area between. Naturally the funds for this large system of roads were limited. Local materials generally used in road construction were not obtainable in this section; in fact, there was no gravel, stone, topsoil, or similar material within a radius of 150 miles. The cost of shipping in material for construction of Asphaltic Concrete, Cement Concrete, and other types of hard surface construction would have been a considerable item. Railroad facilities in some sections are not so good, and these factors made the prospective cost of concrete base and asphalt wearing surface, plain concrete, and other types of pavement run in cost from $3 to $4 per square yard. This high cost would reduce materially the mileage of hard surface roads which it would be possible to construct with the funds available.

Picture a sea of sand stretching for miles along the coast of Eastern North Carolina, and for some distance inland. In many sections this natural sand is practically clean and free from clay or loam which might act as a binder in sand-clay construction. This clean loose sand has no binding qualities, therefore offers very little tractive value to motor vehicles, especially in dry weather, but on the other hand offers great resistance against any vehicle attempting to travel through it. The rear wheels of a motor vehicle spin in the loose sand so it is frequently necessary to go into second or low gear for long distances at a very slow rate of speed.

The problem of building a road through this section was at hand, and the only solution was to develop some type of surfacing in which a large percentage of the local material (sand) could be used.

The birthplace of sand asphalt in North Carolina is in the section previously mentioned, which lies between New Bern and Wilmington, about fifteen miles from the coast and parallels the Atlantic. This section was so sandy that it required about seven hours to travel a distance of 40 miles. Motorists would go about 50 miles out of the way on less sandy roads to evade this sandy section.

An effort was first made to secure clay and mix with the loose sand, but owing to the scarcity of clay, it was necessary to haul a great distance which made sand-clay construction prohibitive, and the idea was abandoned.

The next suggestion as to a type of surfacing was to make an asphalt mixture, using as aggregate the local sand, and importing the asphaltic cement and limestone filler which constitutes only a small percentage of the pavement. The states of Massachusetts, Delaware and Florida had experimented with mixtures of local sand and asphaltic cement for road surfacing with very little success, but North Carolina has now developed the Sand Asphalt type of construction until it is well past the experimental stage. Approximately 57 miles of sand asphalt pavement has been constructed by state forces in North Carolina in the past two years. Five projects, totalling 49 miles, have been let to contract and is now under construction. The pavement first constructed has been down for over two years and has proven satisfactory.

The largest daily production of any type of hard surface construction in North Carolina to date is Sand Asphalt. The Highway Engineering and Construction Company, of Selbyville, Delaware, is completing when weather conditions are favorable, over 1½ miles of 18 foot pavement per week. The plant used is one that was

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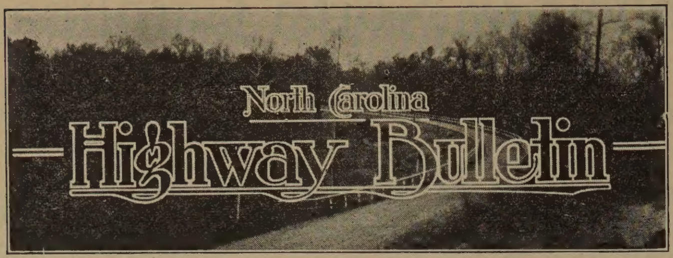

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This BULLETIN will be sent gratis to any State or county official, contractor, newspaper, trade publication, library, or other person interested in the improvement of roads and in the work of the Commission. Advertising rates may be obtained on application.

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Editorial

The compliments of the season are extended to those who are doing the most for the progress of the nation—the road builders.

* * *

One's first impressions of a town are usually the ones that are lasting and the impressions of the thousands of tourists that are using North Carolina's splendid highway system are not always favorable to the towns through which they pass. The citizens of our State should take particular pride in the conditions that exist along the approaches to their respective cities or towns and keep them cleaned up and beautified as much as possible. The cover picture this month shows what has been accomplished in an approach to a thriving North Carolina town.

* * *

The "Road Show" which takes place in Chicago January 4 to 9 promises to be the greatest event of its kind that has ever taken place and "highwaymen" from all over the United States and foreign countries will gather to discuss road building problems and look over the last word in road building machinery. North Carolina will send a representation and will also have an exhibit illustrating road work.

* * *

The need of some method of properly policing the State highways has long been evident and as traffic becomes heavier the necessity increases. Pennsylvania and several other states have inaugurated a State Constabulary with decided success and with a reduction of crime and accidents along the highways. In line with North Carolina's progress it would seem that this is the logical step for the State to take.

* * *

The economic selection of road building material is of vital importance to the success or failure of a road building program. North Carolina is fortunate in having a wide variety of material suitable for use in road building and maintenance. Particularly has the sand-asphalt pavement been of value to the eastern section of the State.

State Police *and* Highway Patrols

(Continued from page 3)

cars, who had previously confined their efforts to the metropolitan districts. The answer was obvious, for unless the officers had a means of overtaking the fastest automobile, his efforts would be useless, and crime would increase rather than be held in check.

The first step in this direction was when Massachusetts put on 125 motorcycles to patrol the state. Next came Pennsylvania with 150 motorcycles in the form of a highway patrol, separate from their State Police, and within the past few weeks, New York State has formed a highway patrol, separate from their state police, and have placed an initial order for 100 motorcycles for this service.

The results obtained by Massachusetts may well be seen by the following statement from General Alfred F. Foote, Commissioner of Public Safety, dated March 15, 1923:

"During last year the force had approximately forty machines in active operation. They covered 302,000 miles, making some eight hundred arrests in cases from murder to small misdemeanors. There was approximately fifty thousand dollars worth of stolen property and fines recovered for the citizens of the commonwealth. They visited practically every town in Massachusetts from time to time during their service. Violations of motor vehicle laws were over three hundred in number. The persons warned for violations, in which the officer did not deem arrest necessary would probably amount to over a thousand."

Since General Foote made the above statement, he has increased his fleet to 125, which bears out his contention regarding the number of motorcycles needed.

Commenting on the second anniversary of the Massachusetts State Police, the Springfield Union says:

"It is felt the patrol system has more than met expectations, and no person that has the highways at all under scrutiny will dispute that its vigilance has become a potent force in curbing reckless driving and enforcing justice against various types of lawbreakers. Those that at first were inclined to inveigh against it have been silenced by its consistent efforts to promote the public safety. Times have changed since agitation for a State Constabulary had its beginning in this state.

"Now that we actually have a mounted police force, the man on horseback is little in evidence. In his place is the fleet motorcyclist, equipped to bring wrongdoers to book. Constabularies of other states are rapidly being modernized to meet existing conditions. This development is the logical accompaniment of the new order that has girdled the countryside with improved highways. It is, indeed, a necessary provision, and the work is only in its early stages, and each succeeding season may confidently be expected to produce better results. The State Patrol has a valuable opportunity to serve the rural population, but to the city man who would enjoy the use of the State highways in a due measure of safety, it is no less an agency to be prized. For that reason it seems assured of liberal support."

The United States Census Bureau of Washington, D. C., released to the press a report on 85 per cent of our population, which shows that in 1923, 11,666 human lives were lost through automobile accidents, or an increase of 1,500 over 1922, to say nothing of the many times this number who were crippled or injured, of which the government has no statistics.

In contrast with these figures we find that in Connecticut, Massachusetts, Washington, Maryland and West Virginia, where state police or highway patrols are in force, the loss of life was much smaller than in the states not so protected. The City of New York, with its terrific amount of traffic, shows a reduction which is attributed to this protection afforded the public. The State of Connecticut showed a loss of 280 lives and 17,000 motor accidents for last year, which has resulted in the police officials asking for an increase of men and motorcycles to curtail this loss of life and property.

The loss of life and property damage by automobiles has already been added to our national hazards of fire and theft, and is occupying the minds of our best traffic and police experts, who view with alarm, the ever increasing dangers of highway travel.

The code of the New York State Police, as laid down by Major Warner, may be used to answer the requirements of other similar organizations. It is:

"Be an interpreter of the law to those who question it—an upholder of those who seek its protection—a relentless enforcer to those who seek to break it. To be successful you must be popular, and to be popular you must be honest, courteous, and fair. Give a maximum of protection with a minimum of interference with the rights of citizens."

The men doing state highway service may be classed as young, bright-eyed, capable officers, who have been selected by a process of elimination, and who have been carefully schooled and trained under strict army discipline to fit them for their work. They are subject to duty all of the twenty-four hours of the day, and are guarding and guiding you throughout the summer, as well as winter. Their presence on the highway should give you a feeling of security, and not resentment, except to the intentional violator of the law.

Every time a state tries to pass a bill creating a state police or highway patrol, the uninformed will always visualize a terrible exense of added taxes, and can only see another burden for the public.

Lieut. A. B. Moore of the New York State Police, shows that the operation of that force cost nothing in 1922, and that it netted the State Treasury $81,000 over and above what had been appropriated to maintain them. During the year $1,000,000 worth of property was stolen from persons in the rural districts. The State Police recovered $983,213 worth of this property, and $158,603 in fines were paid into the State Treasury.

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The Influence *of* Good Roads *on* Public Health *and* Social Welfare

By J. D. Long, *Assistant Surgeon General, U. S. Public Health Service; Assistant to the Director, Pan-American Sanitary Bureau*

IN the medieval and premedieval as well as in more modern times roads were constructed primarily for military purposes. Among some of the oldest and best known are the roads built in England by Caesar, some of which are still in use; the roads of Italy, such as the Appian Way; the old Spanish roads built in Mexico, Central America and Panama, whose foundations in many instances where so solidly built that, with reasonable repairs, they can be utilized for modern traffic needs. Then, too, mention should be made of the historic and romantic Inca Trail, portions of which are still used by the llama caravans which carry the agricultural and commercial products of the Andes regions to lower points where railroad and shipping facilities are available. New towns and cities were built along the course of these roads and wide stretches of land were developed for agricultural purposes, because of the fact that their construction facilitated commerce and communications and increased the opportunities for gainful trade and commerce.

As often happens in trade, manufacturing and industry, the by-products, which were not at first thought of, in the end overshadowed the original purpose of the enterprise, and so it has been with good roads.

In the Philippines, which with Cuba and Panama has been one of the great laboratories in which, since the war with Spain, the United States has had the opportunity to work out so many of its problems unhampered by those restraints and ''checks and balances'' which many times have interfered in the home country with rapid progress, during the administration of Governor General W. Cameron Forbes there was developed and put into practice a definite policy of road construction and maintenance which, as the years have passed, has demonstrated its value and utility in a great many ways and not the least of the benefits has been the effect upon the public health and social welfare.

To illustrate: In 1906 the writer was called upon to make a trip of inspection from Manila to the near-by provinces of Bulacan and Pampanga, on account of the presence in those provinces at that time of a rather sharp outbreak of cholera. The first portion of the trip was made by train, from then on by horse drawn vehicles, such as carromatas, caratelas (two-wheeled vehicles with and without springs), on horse-back, on foot and in bancas (dugouts). Ten days were required for the trip. In 1915 the same identical trip was made and the same duties performed by leaving Manila in an automobile at 6 a.m. and returning the same day at 8:30 p.m. Other instances of the same type could be cited where, to make necessary sanitary inspections, long, roundabout voyages by steamer were required. The same voyage can now be made by automobile comfortably and quickly at a small fraction of the time and expense formerly unavoidable.

In former times the Philippines were visited almost every year by cholera outbreaks or epidemics of varying intensity, beginning, since American occupation, with the extensive outbreak of 1902 with about 370,000 cases and 168,000 deaths, and continuing thereafter with outbreaks of more or less sporadic or semi-epidemic type in varying numbers of towns and villages, but which seldom failed to produce almost every year, in the aggregate, from 12,000 to 20,000 deaths. The administrative difficulties encountered in handling these outbreaks were almost wholly due to poor transportation facilities, and at times were almost insurmountable and the cost and time required were excessive. Nowadays, with better transportation facilities, and the comparative ease with which trained personnel can be sent wherever needed, cholera has almost ceased to be a sanitary problem, and the hope is freely expressed that in a few years more it will practically, if not entirely, disappear.

Of course, the credit for this achievement cannot all be ascribed to good roads, as a multiplicity of other factors contributed as well, but it can be safely said that had it not been for the improved means of transportation, such rapid and effective results could not have been obtained, nor would the other factors, such as improved water supply, improved sewage disposal, improved housing and living conditions and better education, have been advanced to the point of participating so efficiently in obtaining the satisfactory results noted, for

(Continued on page 13)

What Does This Town Look Like?

I WONDER what the next town looks like? Every one motoring through our State for the first time, asks themselves that question; the answer is not very complimentary to most towns.

First impressions are not always correct, but the mind registers pleasure or pain as the eyes see beauty or ugliness and the visitor will no doubt classify the town even if unconsciously, as clean or dirty, depressing or inviting according to the condition of the streets, sidewalks and buildings seen when entering the city.

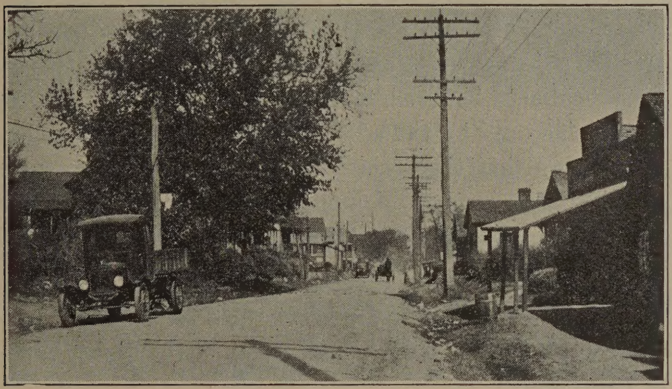
Remember your last trip out of town? and the home coming; old landmarks coming into view reminded you of what? a beautiful city or your work place, possibly both; but if so, it is the exception. The visitor does not know a good business town until he gets into it, he may have heard of it a hundred times, his mind possibly has carried a picture of industrious workers turning out vast quantities of well known articles, but here is the town itself, he says I shall now see for myself where so and so is made, except as a reminder, the article is not interesting him, business may claim him in his home town, but now he is visiting around and every town he comes to makes a different impression on his mind to the one he carried there. That is one reason there's so many of ''him'' going home he tells about his trip through North Carolina (no one can stop him, it seems to be the fashion) and how will your town be remembered? Business only. Tobacco, Towels, Hose, Fertilizer, etc., etc., nothing more added to his previous knowledge of your city? Other visitors may want to see these places if described by him in terms of admiration or pleasure.

North Carolina is getting more advertising than ever and the town that is proud of itself as a living place, must show it, by greeting the visitor, with clean, neat well kept sidewalks and yards, fences etc.

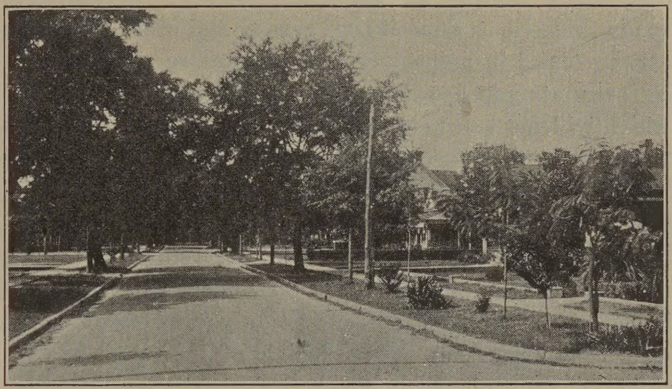
If you will take the trouble to look at the roads leading into your town, you may find some of them very uninviting, others not so bad, one perhaps really clean and neat; but very few towns have beautiful approaches as they ought to have.

Travel is getting heavier and heavier and dust will be raised on the best of roads making it difficult to keep gardens in the best shape, but shrubbery and shade trees on the sidewalks will help both roads and gardens in general appearance, and although the visitor may not see much detail as he passes, the beauty of an avenue of trees or the restfulness of lawns and gardens makes him notice that this town is worth consideration, he knows some one is enjoying life in this place, that they are proud of their part of it, and the community looks cheerful instead of depressing.

The visitor is receiving a good impression before he reaches the business section, and if it is exceptionally pleasing he is going to stop somewhere and look the place over. Otherwise he detours the business part and hurries on; hoping the next town will be inviting enough for him to stay at least long enough for dinner.



WOULD THIS APPEAL TO YOU—



OR THIS?

Road Show More Popular Than Ever

IT looks as though the greatest problem facing the American Road Builders' Association is the discovery of a place big enough to hold its annual Road Show. When the applications for space in the Show, to be held January 5 to 9 next in the Chicago Coliseum and adjoining buildings, were opened it was found that the space available for heavy machinery was 200 per cent over-subscribed and the space in which high machinery could be installed was 400 per cent over-subscribed. It is hardly necessary to say that this made the allotment of space an extremely difficult matter and a new arrangement of aisles had to be worked out before even an approximately satisfactory solution was found.

It was, of course, necessary to make a uniform cut in the space applied for, but the exhibitors, realizing the

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Economical Selection *of* Road Building Materials

(Continued from page 4)

We also have considerable quantities of waste or by-products from industries which may be successfully used in road building. For instance, slag, mine tailings, and chats. Slag may be used in hard surface construction. Mine tailings may be used instead of broken stone in various types of highways, while chats are used in fine graded asphaltic concrete and as a surface cover for treating water-bound macadam. In addition shells, cinders, and other materials of a similar nature may be used in sections where traffic is light. Such materials are serviceable and meet the demands of many local communities.

Some parts of the country have an adequate and well distributed supply of materials suitable for concrete roads. Excellent deposits of coarse and fine aggregate can be found in many localities. Other sections are not so fortunate and are therefore compelled to use material which will not conform to the commonly accepted standards. It is, therefore, the duty of the engineer to devise some means by which these materials may be used to the best advantage. In a discussion of the economic selection of material for concrete pavement, or foundation work there appears to be a necessity for some consideration to be given the methods of proportioning the material, as well as the selection. If materials of this class of construction are to be economically selected it becomes necessary to depart from the standard tests which have been in vogue for some time. Tests have shown that Portland cement varies in quality, as cement from the same mill in certain districts varies almost as much as that from several mills. These conditions should be corrected and the product made standard.

With reference to fine aggregate there is considerable opportunity to work out the economic use of local aggregate, provided the Laboratory is suitably equipped to handle this work and afford intelligent direction and supervision over each given deposit. North Carolina, for instance, in general possesses what would be ordinarily claimed as inferior grade of fine aggregate. Deposits are found somewhat scattered throughout the State which vary considerably in quality when tested by standard test methods. The economic use of this material was made possible by the abandonment of the present standard test for sand and a new method devised. This method consisted of testing each sand in concrete and comparing the results obtained with standard Ottawa sand tested under the same conditions. The coarse aggregate was standardized for this work and the amount of cement and coarse aggregate in both cases were kept constant per unit volume of concrete. The test itself is practically no more expensive than the present standard tests, but it was found by this test that many local sands were made available for use and made concrete as strong as other materials which might pass the standard requirements by considerable margin.

A survey of the local sand deposit situation in North Carolina indicated that but 18 per cent of the local deposits would pass the standard test for sand, while the adoption of the new test method allowed over 90 per cent of the deposits to be utilized. An interesting feature from the economic end was that while certain sands of finer gradation might not come up to the desired strength at the 7 or 28 day period, tests at 3 months to one year would in practically all cases show equivalent strength.

The economic selection of coarse aggregate is a very important matter. It has been found by tests that it is necessary to decrease the maximum size of coarse aggregate if we are to secure economic concrete. Experiments also show that large sizes of coarse aggregate render the slab much more susceptible to impact stresses than when smaller sizes are used, and that the size of the coarse aggregate should be considered in relation to the thickness of the slab, and by the adjustment of sizes of coarse aggregate we find that relatively inferior local aggregate can be used instead of importing stone, which when tested under similar conditions shows a higher strength.

Asphalt has a wide diversity of use in highway construction. Its products are serviceable for surface treatment work, as well as the construction of the higher types of pavement.

It has generally been considered that asphalt surfacing should be laid upon monolithic foundations. However, there have been a number of old macadam roads reclaimed by utilizing these old roads as bases, and resurfacing them with an asphaltic concrete surface.

In some states, especially those along the South Atlantic Coast, local deposits of marl or lime rock have been found which make an excellent foundation for a hard surface wearing course. This material is generally found adjacent to rivers or streams, can be easily excavated in the pit, and when placed on the graded roadbed and rolled with a 10-ton roller has sufficient cementing qualities to make a firm and well compacted foundation. On this base can be constructed a 1″ wearing coarse of sheet asphalt surface mixture, which will give a type of pavement that promises to meet all traffic requirements for many years.

Each state has its own detail problem in regard to an economic selection of road building material. Highway research if practicably applied will solve many of these problems and be helpful in the expenditure of available funds for road building purposes. It is necessary that the research work be carried on in a systematic manner so that the results derived may be of assistance to other states in their road building programs.

Development *of* Sand Asphalt *in* N. C.

(Continued from page 5)

partially designed by Mr. J. McK. Spears, Superintendent of the Company, formerly construction engineer for the N. C. State Highway Commission. This plant produces a 2000 pounds batch, and has two drying units.

THE MIXING PLANT

The progress with which a large highway construction program may be carried out in any state, providing necessary funds are available, depends, in addition to weather condtions, on two main limiting factors, namely: the number of available competent contractors, and the ultimate quantity of road material available, and the facilities for transporting these materials. As long as payments are assured the contractors, and there is a fair margin of profit in the work, the number of competent contractors will increase, so that is not the only limiting factor; but the main factor is, that no more miles of hard surface road can be built than there are materials available, at an economical cost. Furthermore, these materials must be transported to the job, and railroad facilities are always limited during the peak of construction season. Therefore, the use of about 87% of local materials in the construction of a hard surfaced road, as in Sand Asphalt pavement, reduces the cost considerably and makes that much more cement, sand, stone and gravel available for other jobs which do not have local materials and releases a large number of railroad cars for duty elsewhere.

In construction of Sand Asphalt pavement, it is first necessary to determine if there is a sufficient quantity of suitable sand available along the proposed project.

On the first ten mile section of Sand Asphalt construction in North Carolina, a sand pit was found which gave a sheet asphalt heavy traffic grading. The sand was practically pure silica, clean, hard and fairly angular. When investigations were later made for suitable sand to be used on a number of other Sand Asphalt projects in various sections, it was found that the sand available was similar in quality to the sand used on the first project, but uniformly much finer in gradation; practically all of it passed a 40 mesh screen.

To secure a sheet asphalt grading, it would be necessary to ship in coarser sand from some distant point and combine with the local sand. This would have materially increased the cost and defeated the purpose of Sand Asphalt construction, which was the utilization of local materials, to secure a low cost of construction. The suggestion was then made that a uniform grading be maintained between the 40 and 200 mesh, instead of the sheet asphalt grading between the 10 and 200 mesh. This was done, and the work progressed on this basis, with results that have been entirely satisfactory.

Average grading of this uniformly finer graded sand is as follows:

Pass	10	2.3%
	40	29.5
	60	14.7
	80	29.2
	100	17.5
	150	2.1
	200	4.7
Total		100.0%

Varying from the standard sheet asphalt grading of sand, is a new development, and on lightly traveled roads is proving very satisfactory, and has opened a wider field for Sand Asphalt pavement, in that it provides much greater areas, in which local sand may be used.

The preparation of the subgrade is one of the most important details of construction. An important prerequisite for the success of the Sand Asphalt pavement is a well drained subgrade, and one which offers a uniform bearing surface. This is true of any type of pavement, but is of more importance in the case of Sand Asphalt, or any type of black base pavement as these pavements are more or less flexible, and under traffic will conform to any change or movement of the subgrade, resulting in an irregular surface and perhaps failure.

The material in the subgrade of most Sand Asphalt projects in North Carolina is loose sand, and is preferable because loose sand when confined offers a uniform and well drained subgrade, but on some projects the subgrade is sand clay, with a high percentage of sand. The clay present aids in binding the sand under rolling and gives a hard subgrade surface. This sand-clay subgrade is proving very satisfactory, but on projects where the subgrade is of this nature it is especially important that good drainage is secured.

In preparing the subgrade, it should be plowed and scarified to a sufficient depth to secure uniformity, harrow if necessary to break down hard lumps of sand and clay, shape to the desired cross section, and roll to ultimate compaction. If undesirable material is present in the subgrade, such as excessive clay, muck, vegetable matter, or other unsuitable material, same should be excavated, thrown out of the roadway and replaced with sand. It is desirable to keep the grade of the pavement as high as practicable in low flat country, particularly where swamps are encountered.

The ideal set up for the plant is the case in which the road to be paved parallels the railroad, and the sand pit located about midway the project. The plant is set both convenient to the railroad and the sand pit. It is then possible to ship the Asphaltic Cement and filler on the railroad siding, and haul the sand from the pit to the plant by slip teams or mechanical devices. It is economical to set the plant as near the sand pit as possible, so as to minimize the haul of the sand to the drying unit. This set up offers ideal conditions for low cost of construction.

If the railroad does not parallel the projected highway, it is perhaps the logical set up to put the plant at the sand pit, and haul the Asphaltic Cement from the nearest railroad in trucks equipped with tanks, and haul the filler in sacks. Where the set up is made off the highway, it is sometimes necessary to build a driveway to facilitate the movement of the trucks hauling the mixture. An asphalt storage tank and also a fuel oil tank equipped with heating coils should be part of the plant equipment, as it reduces demurrage on tank cars, and offers a reserve supply of asphalt and oil. For hauling, it has proven more economical to use light pneumatic-tired one ton trucks.

Sand Asphalt pavement is being constructed in widths of 10, 16 and 18 feet. A very large number of miles of sand asphalt pavement is needed and funds must be conserved as much as possible in order to secure the highest mileage possible. Therefore, in undeveloped sections, a 10 foot width has been adopted; whereas, in the more populated sections and near cities and towns, 16 and 18 feet sections have been adopted. In later years, if traffic demands it, it will be easy to widen the 10 foot section, but at present, traffic is so light, that the 10 foot section is sufficient. Of course it is necessary in vehicles passing to get the right wheels on the shoulder; therefore, shoulders are being constructed of sand, with a two or three foot section adjacent the pavement of sand-clay, topsoil, or any available material which will offer a bearing surface for vehicles turning out on to them. If this material is not available, every effort is made to get a stand of grass growing.

Old Road Before Paving

The grade is built up 30 feet wide, whether the road is built 10 or 18 feet wide.

Forms are used to confine the pavement during rolling and to protect its edges from traffic after completion. The forms are 2″ x 8″ Cypress or Long Leaf Pine, 10 to 15 feet long, and are held in place by 2″ x 4″ stakes, 24″ long, spiked to the form at about 2-feet intervals. The forms are set to line and grade by the form setting gang, and are followed by the fine grading gang which completes the grading and prepares the subgrade properly, prior to the laying of the base course.

The base course is composed of about 93% local sand and 7% asphaltic cement and requires only about 45 seconds mixing to produce a homogeneous mixture. It is prepared at the plant similar to any hot mixture. The base course temperature when delivered to the road should be 275 to 325 degrees F. It is dumped upon a steel dumping board to protect the mixture from the loose material on the subgrade. The mixture is shoveled into place and raked to sufficient depth which is checked by a template to give 3″ finished base, after ultimate compaction with an 8-ton tandem roller. Rolling is done longitudinally, beginning at the sides and proceeding toward the center. The finished surface of the base is checked for irregularities, with a 10 foot, straight edge, and patches made if necessary. Every effort should be made to get the surface of the base smooth, for reason that the top will conform to it. The average density of the base course ranges from 1.80 to 1.85.

The Finished Road

The wearing surface, or top course, consists of about: 10.5% asphaltic cement; 15.5% filler; and 74% local

(*Continued on page 21*)

The Influence *of* Good Roads *on* Public Health *and* Social Welfare

(Continued from page 8)

they, too, and their development, were dependent upon good and efficient means of transportation.

In 1906 it was found that the geological formation of extensive portions of the Philippines was such that fair likelihood existed of obtaining artesian water for drinking and domestic use to replace the unsafe and in many instances actually dangerous water supplies that the people had heretofore been compelled to use.

The first wells were drilled within easy reach of the railroad, because the transportation of heavy drilling apparatus was thus facilitated. In some of the towns where the first wells were drilled the death rate fell as much as 50 per cent in the first year after safe water became available. The decline in deaths was due to a diminution in intestinal diseases, dysenteries, et cetera, and was especially noticeable among infants and children.

Following the excellent results obtained from the first wells drilled, the demand became so great and so insistent from other towns and villages that well drilling apparatus could hardly be obtained with sufficient rapidity to meet the situation, and in order that demands be met as rapidly as possible the drilling apparatus followed such roads as existed or were passable, drilling as it proceeded, but of necessity omitting such towns as were difficult of access. As soon as good roads became available the drilling of wells progressed with much greater rapidity, drilling apparatus was used to much better advantage, and towns and villages that formerly had to be passed by were provided with wells. In all, something over 2,500 wells have been provided, and the statement has been made that probably over one-half of the population of the Philippines now have safe water for daily use.

It is not improbable that the provision of good water has contributed in larger measure than almost any other factor in the reduction of the death rate in the Philippines from its former average of 40-45 per 1,000 population to its present average, 20-25 per 1,000, and to an increase in population from about 7,000,000 as shown by the official census of 1903 to over 10,000,000 as shown by the official census of 1918. The increase in population shown was not due to immigration, as immigration has always been a negligible factor. It is generally conceded that the increase can be ascribed to two principal factors, namely excess of births over deaths, due to decrease in death rate, and to a more complete census in 1918 on account of better transportation facilities and improved means of communication.

The same influence of good roads on social betterment and improvement in housing and living conditions has been so evident in the United States and in other countries, and has become so much a part of our everyday life that it no longer attracts attention. It will suffice to call to mind the experiences of our cities and towns when new additions, extensions or suburbs have been opened, and roads, streets, car lines and bus services have been placed in operation.

On the recent trip of the Pan-American Highway Commission through various States, one of the most noticeable features along the entire route traveled was the hundreds of new houses recently constructed or under construction, and the great numbers of houses already constructed that were being repaired or were having additions built. In numbers of places sidewalks were being constructed parallel to the highways, lawns were being prepared and gotten in shape, trees were being planted, barns and outbuildings were being repaired and painted, and new fences of more permanent and ornamental types than formerly were well under way.

From the educational standpoint, new school houses were being built, or old ones were being enlarged and repaired. Regular bus services were provided to carry children to and from school, in some instances without charge, and in other instances at very low cost. This means that an increasing number of children will have the advantage of grade schools and high schools, whereas under former conditions they were forced on the average to be satisfied with primary or lower grade educational facilities.

From the standpoint of social service, dispensaries, children's clinics, both medical and dental, and maternal and babies' clinics are more readily accessible where good roads are available, and many lives are saved due to more prompt medical treatment and many illnesses are prevented, and inherited or acquired defects are ameliorated or removed before serious damage is done. Physicians, visiting nurses, public health nurses and similar helpful agencies have their efficiency increased many fold, and can carry service to ever-increasing numbers of families and persons, thereby raising the standard of living, improving personal hygiene, reducing sickness and death rates, and increasing health and happiness to the individual through making it possible for him to become and continue to be a useful and productive member of the body politic.

From the standpoint of recreation, interchange of ideas, broadening of the individual viewpoint, and development of the imitative faculty, so as to afford opportunity for the individual to see what his fellow-man is doing and to understand him better and to adapt to his own and his family's use those things that he has seen that may seem to him good and useful, good roads have been and will continue to be absolutely indispensable and of prime necessity.—*American Highways.*

STATUS OF STATE WORK IN NORTH CAROLINA

Projects Under Construction

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
102	Beaufort	8.62	Graded	$ 50,020.00	4—8-24	H. M. Beasley.
104A	Beaufort		Recon. Br.	16,190.00	10-25-22	State Forces.
104B	Beaufort		Recon. Br.	18,260.00	5-29-23	State Forces.
107	Bertie	19.30	Graded	129,400.00	5-28-23	Nello Teer—Atlantic Bridge Co.
107B	Bertie	12.00	P. C.	347,017.00	8-22-24	Frank Mitchell Construction Co.
113B	Chowan	12.20	S. A.	121,000.00	4—9-23	State Forces.
115	Chowan-Perquimans	11.83	P. C.	326,300.00	5-15-23	Smith Brothers, Inc.
118	Currituck	3.40	T. S.	17,840.00	10-10-23	State Forces.
119	Currituck	29.90	T. S.	123,360.00	11—7-23	State Forces.
124	Edgecombe		Recon. Br.	8,990.00	6-12-23	State Forces.
126 FA	Edgecombe	7.72	P. C.	288,480.00	11-15-23	Public Service Production Co.
131 159A	Gates	15.95	T. S.	157,130.00	8-22-22	Bacon & Moore—W. D. Murray—Saddler Corp.
133	Gates-Pasquotank	14.07	Gravel	213,250.00	1-17-22	C. W. Lacy—Pittsburg-Des Moines Steel Co.
138B	Northampton-Halifax		Bridge	381,910.00	2-28-23	Pensacola Shipbuilding Co.
141	Halifax-Edgecombe	8.76	T. S.	220,680.00	8—8-23	J. P. Dicus—J. A. Peterson.
146	Hertford-Bertie	6.42	T. S.	60,780.00	8—8-23	Nello Teer—Atlantic Bridge Co.
147B	Hertford	8.98	P. C.	252,163.00	9—8-24	Roberts Paving Co.
148	Hertford-Gates		Bridge	148,410.00	4-15-24	Roanoke Iron and Bridge Co.
152	Hyde	10.89	S. C.	137,180.00	1-15-23	O. A. Mann & Co.
155B FA 152	Martin	19.30	P. C.	551,800.00	3-20-23	W. T. Hadlow.
156	Martin	17.51	Graded	214,350.00	4-24-24	Nello Teer—J. A. Peterson.
162 FA	Nash	12.16	T. S.	49,110.00	4-28-24	J. F. Mulligan Construction Co.
163 149	Nash	14.96	P. C.	448,490.00	6-15-23	Public Service Production Co.
167	Northampton	20.48	T. S.	117,260.00	7-17-22	Virginia Contracting Co.—Bacon & Moore.
168	Northampton	16.30	T. S.	107,230.00	8-27-23	Nello Teer.
170	Northampton		Recon. Br.	3,660.00	5-23-22	State Forces.
172	Pasquotank		Recon. Br.	4,330.00	4-10-22	State Forces.
173	Perquimans-Pasquotank	7.22	R. C.	239,450.00	8-25-22	Williams & Williams.
180	Perquimans	9.96	P. C.	249,190.00	10—8-23	Smith Brothers, Inc.
183B	Pitt		Bridge	32,340.00	3-27-22	B. J. Boyles.
185c FA 164	Pitt	14.35	P. C.	481,940.00	10—6-23	Groves & Shephard.
187 FA	Pitt	4.43	P. C.	171,700.00	11-15-23	Public Service Production Co.
192 159B	Tyrrell		Recon. Br.	7,510.00	7-21-22	State Forces.
200B	Carteret	13.68	S. A.	240,000.00	4-30-23	State Forces.
202	Carteret		Bridge	20,540.00	3-27-24	Roanoke Iron and Bridge Co.
205	Craven		Recon. Br.	20,000.00	10-25-22	State Forces.
206	Craven		Recon. Br.	40,000.00	11—5-23	State Forces.
213 FA 151	Craven	10.43	A. C.	447,200.00	8—1-23	F. G. McGuire—Eagle Engineering Co.
221 FA	Duplin		Recon. Br.	3,820.00	1-13-23	State Forces.
222 143	Duplin	10.00	S. A.	305,490.00	2-23-23	Highway Engineering and Construction Co.
237A	Johnston	.51	Grade	84,250.00	1—9-24	Jameson & Bro.—Dameron & Sparling.
257	Lenoir		Recon. Br.	3,930.00	5-25-24	State Forces.
265	Pamlico	10.82	Grade	132,198.00	9—2-24	J. F. Mulligan—R. W. Curtis.
266	Pamlico	7.20	Grade	50,263.00	9—1-24	J. F. Mulligan—Bradley & Gooch.
275A	Sampson	13.12	S. A.	301,560.00	2—4-24	Highway Engineering and Construction Co.
276	Sampson	9.5	S. A.	185,070.00	10—8-24	Hudson & Scruggs.
302	Bladen	1.25	Bridge	286,470.00	11-26-23	J. A. Plott—Atlantic Bridge Co.
330	Columbus	11.22	A. C.	364,900.00	5-19-24	Coastal Construction Co.
340	Cumberland	11.07	P. C.	395,970.00	6-15-22	Alabama Concrete Prod. Co.-Hobbs & Peabody.
343	Cumberland		Recon. Br.	25,000.00	9—6-23	State Forces.
344	Cumberland	5.52	Conc.	174,080.00	7-30-24	Alabama Concrete Products Co.
366	Onslow	18.5	S. A.	200,000.00	6-15-23	State Forces.
380	Pender	8.98	W. B. Mac.	185,200.00	3—6-23	C. W. Lacy.
381	Pender	11.99	S. A.	264,300.00	6-25-24	Highway Engineering and Construction Co.
386 FA 387 140	Robeson	19.80	P. C.	646,200.00	9—4-22	Jas. O. Heyworth.
402	Chatham	6.92	T. S.	38,500.00	8—1-22	W. N. Thompson.
403	Chatham	7.01	Gravel	82,500.00	2-17-23	C. G. Kershaw.
404A	Chatham	11.25	Grade	141,870.00	12—1-23	W. W. Tuck & Son—Atlantic Bridge Co.
412	Durham	8.80	P. C.	252,590.00	11-15-22	L. L. Tindall.
421	Franklin	8.23	Grade	60,060.00	10-20-23	J. A. Marrow.
429 FA	Granville	6.94	P. C.	261,400.00	3-21-23	R. B. Sandidge.
431	Granville	3.83	T. S.	42,180.00	8-25-23	Micheaux Construction Co.
437	Harnett	10.74	Gravel	101,710.00	5—8-23	F. P. Holden—T. J. Newell.
438	Harnett	3.82	P. C.	158,320.00	7-16-23	J. M. Gregory—T. J. Newell.
444	Lee-Harnett	7.0	Gravel	32,000.00	8-29-23	State Forces.
449A	Lee	2.50	Grading	29,020.00	2-21-24	Austin and Ritchie, W. B. Boyle Co., Inc.
457B	Orange	7.32	P. C.	253,370.00	5—1-24	L. L. Tindall.
463	Person	11.24	P. C.	327,170.00	8-14-22	Porter & Boyd.
464	Person	11.58	T. S.	85,470.00	8-13-23	Micheaux Construction Co.
472B	Vance	4.66	T. S.	84,110.00	2-11-24	C. A. Ragland—Rhyne & Kitchen.
474	Vance	11.43	Grade	59,197.00	8-28-24	C. A. Ragland.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
485A	Wake	7.35	Graded	$ 92,820.00	5—4-23	C. G. Kershaw Constr. Co.—T. J. Newell.
485B	Wake	7.81	P. C.	271,100.00	4-17-24	R. G. Lassiter & Co.
486	Wake	9.04	T. S.	49,500.00	4-11-23	O. A. Mann & Co.
493 {F A 147	Warren	3.88	Bit. Mac.	77,870.00	7-27-22	Porter & Peck.
495	Warren	7.96	T. S.	69,930.00	9-18-23	J. A. Marrow.
513	Caswell	16.34	T. S.	200,490.00	1—8-24	Nello Teer—R. W. Curtis.
528Ex	Davidson	.93	P. C.	29,990.00	6-29-23	Hagedorn Construction Co.
535	Guilford	7.78	P. C.	282,550.00	9-21-22	Leaksville Lumber Co.
537B	Guilford	10.99	P. C.	420,480.00	4-29-24	Zeigler & Dalton—Kiker & Yount.
556	Montgomery	3.07	A. C.	82,140.00	9—4-23	R. G. Lassiter & Co.
568	Moore	11.96	Graded	91,650.00	4-29-24	J. F. Mulligan Constr. Co.—E. A. Wood & Co.
570	Moore	22.52	T. S.	89,800.00	5-22-23	A. B. McDonald.
580B	Randolph	----------	Br.	45,630.00	7-15-24	Dameron & Sparling.
582	Randolph	16.60	T. S.	55,000.00	11-6-24	Jamison & Brothers.
588	Rockingham	7.98	R. C.	266,520.00	4-11-22	Cheatwood & Driscoll.
592	Rockingham	8.22	P. C.	310,100.00	10-20-23	Zeigler & Dalton—J. L. Brinkley.
608	Anson	7.85	A. C.	361,020.00	9-27-22	Lampton & Burks—J. A. Peterson.
608B	Anson	3.83	Grading	51,280.00	7-20-23	Ben F. Teeter—J. A. Peterson.
611	Anson	5.94	P. C.	194,200.00	9—1-23	Jas. O. Heyworth.
614 {F A 144	Cabarrus	9.20	P. C.	354,080.00	7-21-22	A. L. Harris—Oliver & Costello Brothers.
616	Cabarrus	8.59	T. S.	120,220.00	4-11-23	Lee J. Smith—L. M. Lefler & Smith.
617	Cabarrus	7.03	A. C.	68,843.00	7—1-24	Noll Construction Co.
629	Catawba	7.52	P. C.	258,660.00	6—5-22	A. L. Harris—R. M. Thurmond & Co.
640	Iredell	8.17	Bit. Mac.	181,990.00	9-26-22	W. E. Graham.
641 {F A 157	Iredell	8.04	A. C.	305,690.00	10—9-23	Iredell County.
643	Iredell	8.57	A. C.	321,610.00	5-21-23	Stearns Brothers.
646A	Lincoln	9.88	Graded	44,060.00	1—4-24	J. F. Mulligan Constr. Co.—Harris & Spaulding.
647	Lincoln	7.10	P. C.	250,100.00	6—5-22	A. L. Harris—R. M. Thurmond & Co.
647B	Lincoln	----------	Bridge	24,350.00	1—4-24	J. S. Bowers.
648A	Lincoln	5.03	Graded	53,450.00	1—4-24	Gus Ginn.
658 {F A 145	Mecklenburg	9.55	A. C.	304,800.00	10—9-22	Union Paving Co.
659	Mecklenburg	7.93	Graded	50,000.00	----------	County Forces—Luten Bridge Co.
659B	Mecklenburg	7.93	A. C.	255,030.00	10-22-23	Mecklenburg County.
662A	Richmond	6.19	Graded	72,730.00	3-18-24	T. W. Chandler—Yadkin Construction Co.
666	Richmond	4.65	P. C.	175,050.00	1—8-24	Geo. R. Martin & Co.
671	Rowan	7.34	A. C.	310,720.00	3-20-23	Thompson-Caldwell Constr. Co.—Atlantic Bridge Co.
672	Rowan	3.56	A. C.	162,130.00	8-27-23	Stearns Brothers—J. A. Kreis.
677	Scotland-Robeson	8.6	P. C.	286,350.00	4-26-22	P. R. Ashby—J. B. Murphy.
679	Scotland	11.1	P. C.	402,070.00	7—1-23	P. R. Ashby—E. T. Gwathmey.
686	Stanly	16.51	Graded	104,660.00	12-11-23	Lee J. Smith—J. L. Brinkley & Sons.
697A	Union	9.5	P. C.	307,180.00	9—1-23	Jas. O. Heyworth.
702A	Alleghany	7.75	B. M.	245,300.00	10-31-22	O'Brien Const. Co.—Luten Bridge Co.
702B	Alleghany	6.49	Gravel	84,382.00	11-16-23	Turner-Hartsoe—Luten Bridge Co.
712	Ashe	11.06	Gravel	197,690.00	10-24-22	J. T. Plott.
714	Ashe	5.33	Gravel	37,500.00	5-19-24	State Forces.
720	Caldwell	----------	Bridge	39,920.00	3-17-24	W. C. Carter-Berry-Fortune Const. Co.
721	Caldwell	13.75	T. S.	168,680.00	4-14-24	J. T. Plott—Harris & Spaulding.
750	Stokes	14.86	T. S.	91,820.00	9-15-21	J. F. Mulligan Constr. Co.—Lee J. Smith.
750B	Stokes	6.83	T. S.	138,400.00	1—4-24	Mulligan Constr. Co.—Piedmont Constr. Co.
763A	Surry	10.54	Graded	164,130.00	10-24-23	McDowell Contracting Co.—C. A. Heilig.
770B	Watauga	8.90	Gravel	93,500.00	4-16-23	State Forces.
771A	Watauga	2.50	Bit. Mac.	30,000.00	9—7-22	State Forces.
780	Wilkes	7.83	Recon.	25,000.00	11-25-21	J. F. Mulligan—State Forces.
780B	Wilkes-Alleghany	5.39	Grade	106,053.00	9-24-24	J. F. Mulligan.
781	Wilkes	14.50	Recon.	250,000.00	8—8-21	J. F. Mulligan—State Forces.
790	Yadkin	10.12	P. C.	339,450.00	4-24-22	Pittman Construction Co.
802	Avery	5.68	Graded	118,070.00	7-30-23	Hughes & Rae.
812A	Burke	4.89	Grading	61,770.00	7—6-23	M. A. Kolloch—Padgett & Justice.
812B	Burke	6.17	P. C.	195,367.00	8-11-24	Overstreet & Nance.
836A	Henderson	9.10	Grading	175,980.00	5-23-24	J. B. Hawkins—J. L. Von Glahn & Co.
836B	Henderson	9.51	P. C.	311,250.00	5—6-24	J. M. Gregory & Co.
847	McDowell	3.84	Graded	107,580.00	10-19-22	C. W. Lacy—Oliver & Costello Brothers.
849	McDowell	14.00	Gravel	75,000.00	10—2-23	State Forces.
852	McDowell	10.85	P. C.	237,960.00	5—7-24	Appalachian Construction Co.
860	Mitchell	5.58	W. B. Mac.	157,840.00	4-21-22	J. F. Mulligan Constr. Co.—W. H. Anderson Constr. Co.
882C	Rutherford	----------	Bridge	13,300.00	----------	State Forces.
888	Yancey	15.22	W. B. Mac.	308,000.00	6-23-24	The Luck Co.
891	Yancey	7.27	Grade	36,404.00	11-28-24	W. H. Anderson Constr. Co.
900	Buncombe	9.09	Grade	195,902.00	8-25-24	W. E. Graham—J. M. Gregory & Co.
901 {F A 148	Buncombe	7.52	P. C.	359,730.00	11—6-22	R. C. Stevens—A. J. Wardrep.
902	Buncombe	4.95	P. C.	236,110.00	10—8-23	Wilson Construction Co.—R. G. Rand.
913	Cherokee	10.33	W. B. Mac.	99,550.00	8—8-22	Mills-Williams Construction Co.
940 {F A 16	Haywood	7.13	W. B. Mac.	112,550.00	4-14-22	Alexander & Patton—H. A. Brown & Co.
944	Haywood	10.18	A. C.	409,680.00	5-14-23	A. J. Wardrep.
944 Ext	Haywood	1.45	A. C.	59,660.00	----------	State Forces.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
951	Jackson	11.58	W. B. Mac.	$ 269,540.00	8-17-22	R. H. Wright & Sons—W. T. Moore Conc. Prod. Co.
952A	Jackson	10.35	Graded	220,000.00	8-17-22	Brooks-Calloway Co.
953	Jackson	12.72	Graded	118,200.00	7—1-22	C. C. McCabe.
962	Macon	13.58	W. B. Mac.	177,840.00	5-19-22	O'Brien Constr. Co.—Griffin Constr. Co.
963	Macon	8.68	Graded	125,220.00	11-10-22	Costello Bros.—Brooks-Calloway Co.
964	Macon	2.85	Gravel	15,000.00	11—1-22	State Forces.
971	Madison	6.74	Gravel	183,090.00	5-15-23	Reynolds Constr. Co.—Moore Conc. Prod. Co.
972	Madison	6.60	Grading	50,000.00	4—6-23	State Forces—C. M. Dicus.
975	Madison	4.0	Grading	25,000.00	3-25-24	State Forces.
980	Macon-Swain	17.84	W. B. Mac.	278,050.00	3-20-22	Costello Bros.—Condon & Condon.
990	Transylvania	8.87	W. B. Mac.	158,020.00	6—5-22	Sam L. Davis Constr. Co.—R. C. Stevens.
991	Transylvania	7.03	Graded	156,650.00	3—6-23	Gibson Construction Co.

Projects Completed

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
100	Beaufort	10.50	R. C.	$ 396,580.00	3-15-23	W. T. Hadlow.
101	Beaufort	4.23	P. C.	146,820.00	2-15-24	Public Service Production Co.
103	Beaufort	.03	R. C.	1,740.00	7—3-22	R. G. Lassiter.
105A	Beaufort	2.00	P. C.	72,560.00	7-16-23	J. L. McGhee Contracting Co.
105B	Beaufort	5.04	P. C.	154,300.00	4-15-24	Public Service Production Co.
106	Bertie	7.12	T. S.	70,480.00	12—3-23	J. F. Mulligan Constr. Co.—Boney & Hostetler.
108	Bertie	--------	Sheet P.	14,540.00	1-17-24	E. T. Gwathmey.
110	Camden	2.71	R. C.	123,910.00	7-20-23	State Forces.
113	Chowan	10.32	Graded	55,060.00	3—1-23	Nello Teer—Gregory & Talbot.
114	Chowan	10.40	Graded	52,570.00	4-14-23	Battershill & Goode—Chandler & Ragland.
125	Edgecombe	15.11	A. C.	421,480.00	4-23-23	R. G. Lassiter.
129	Edgecombe	8.10	T. S.	36,000.00	1-12-24	State Forces.
132	Gates	10.90	T. S.	69,950.00	2—1-24	J. A. Marrow.
137	Halifax	5.95	P. C.	229,810.00	1-19-24	O. F. Leighton—A. C. House.
138A	Halifax-Northampton	12.59	S. C.	132,820.00	5-14-24	Nello Teer—Richards Bros.
139	Halifax	0.55	S. C.	20,830.00	8-25-22	Chandler & Ragland—Porter & Peck.
140	Halifax	--------	Bridge	11,060.00	5—5-22	Von Glahn & Talbott.
145	Hertford	12.88	Graded	139,590.00	11-23-23	Jamison & Brothers—Atlantic Bridge Co.
147	Hertford-Bertie	17.36	Graded	122,250.00	5-23-24	Nello Teer—Atlantic Bridge Co.
151	Hyde	4.30	T. S.	84,000.00	3-28-24	C. W. Lacy—Porter & Peck.
154	Martin	11.27	A. C.	407,940.00	11-16-23	So. Willite Paving Co.—O. F. Leighton, Inc.
154B	Martin	1.34	A. C.	43,830.00	10—8-23	State Forces.
155	Martin	19.3	S. C.	128,100.00	8—9-23	J. P. Dicus—J. M. Gregory.
157A	Martin	12.41	T. S.	102,530.00	3—5-24	Jamison Bros.—J. A. Marrow.
157B	Martin	12.36	T. S.	104,180.00	5-13-24	J. F. Mulligan Constr. Co.—Batson-Cooke Co.
159	Nash	11.22	S. C.	98,990.00	7-30-23	J. A. Kreis & Co.
160	Frklin.-Wake-Nash	9.81	S. C.	54,000.00	3—7-23	Chandler & Ragland—Southern Dray Co.
166	Northampton	.47	Bridge	24,190.00	9-14-22	W. D. Murrey—Sadler Corp.
174	Pasq.-Camden	2.40	Cord.	70,820.00	2-29-24	D. E. Williams.
175	Pasquotank	9.50	Brick	222,213.00	4-19-23	County Commissioners.
178	Perquimans	1.0	A. C.	28,700.00	------------	Built by Town.
183A	Pitt	13.54	P. C.	390,180.00	9-20-23	S. J. Groves & Sons.
184	Pitt	7.14	P. C.	228,670.00	9-25-23	Public Service Production Co.
185A	Pitt	14.35	Graded	33,470.00	8-13-23	J. A. Marrow.
185B	Pitt	--------	T. S.	5,180.00	1-20-23	Force Account.
186	Pitt	9.57	R. C.	248,360.00	8—5-22	Cheatwood & Driscoll.
189	Pitt	5.30	P. C.	193,370.00	4-18-24	Smith Bros.—Pittsburg-Des Moines Steel Co.
191	Tyrrell	6.91	S. C.	81,550.00	2-16-24	C. W. Lacy—M. M. Jones.
195	Washington	15.18	S. C.	76,660.00	3-19-24	L. M. Lee & Co.
196	Washington	14.93	S. C.	89,100.00	1-19-24	W. N. Thompson.
200	Carteret	13.68	Graded	137,300.00	1-23-24	Eagle Engineering Co.—Batson-Cooke Co.
201	Carteret	14.14	Grade	90,760.00	7-16-24	Duplin Construction Co.—Batson-Cooke Co.
207	Craven	3.00	Gravel	3,810.00	11-30-22	State Forces.
208	Craven	4.50	Gravel	7,400.00	11-25-22	State Forces.
209	Craven	2.65	R. C.	119,470.00	1-28-22	Eagle Engineering Co.
210	Craven	8.34	A. C.	305,410.00	12-26-23	West Construction Co.—A. P. Gilbert.
211	Craven	9.93	A. C.	269,610.00	5-16-23	Union Paving Co.
218	Wayne-Duplin	16.06	Graded	97,190.00	2-24-23	C. W. Lacy.
219	Duplin-Lenoir	15.80	Grade	159,500.00	8-30-24	Chitwood & Carpenter.
220	Wayne-Duplin	14.53	A. C.	394,300.00	7—3-24	Union Paving Co.
227	Greene	6.81	A. C.	235,540.00	1-25-23	West Construction Co.—Union Paving Co.
230	Greene	5.40	F. C.	220,570.00	4-26-24	Smith Bros.—Pittsburg-Des Moines Steel Co.
236	Johnston	14.83	A. C.	475,320.00	7—2-24	R. G. Lassiter & Co.
245	Jones	15.80	P. C.	407,090.00	4-18-24	Hyde & Baxter.
254	Lenoir	--------	Bridge	73,420.00	5-27-24	Roanoke Iron and Bridge Works.
255	Lenoir	.82	S. A.	30,380.00	10-30-22	West Construction Co.
256	Lenoir	--------	Bridge	64,040.00	8-13-24	Englehardt-Kuehn Co.
263	Pamlico	12.03	A. C.	291,880.00	10—8-23	Union Paving Co.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed (Continued)

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
264	Craven-Pamlico		Bridge	$ 24,460.00	10-24-23	Rhyne & Kitchen.
272	Sampson	16.47	Graded	98,750.00	11-16-23	R. E. Martin—Striblin-Standdy & Newell.
273	Sampson	3.76	P. C.	113,720.00	10-31-23	Eagle Engineering Co.
275	Sampson		Bridges	8,770.00	8-22-23	Rhyne & Kitchin.
280	Wayne	10.01	A. C.	318,940.00	5-12-23	Union Paving Co.
281	Wayne		Bridge	22,080.00	1-15-23	P. R. Ashby.
282	Wayne	14.22	A. C.	411,050.00	3-10-24	Union Paving Co.
291	Wilson	7.63	A. C.	203,490.00	12-15-23	P. R. Ashby.
291B	Wilson		Bridges	17,540.00	11—1-23	John M. Ogden & Co.
291C	Wilson	0.31	Graded	15,530.00	7-17-24	C. S. Wheeler.
293	Wilson	8.99	P. C.	384,220.00	9-13-24	Smith Bros.—Pittsburg-Des Moines Steel Co.
294	Wilson		Bridge	19,360.00	11-22-23	Stearns Brothers.
295	Wilson	9.92	Recon.	122,670.00	5-16-24	Highway Engineering & Construction Co.
300	Bladen	11.99	S. C.	75,700.00	6-16-23	T. W. Chandler—Nello Teer.
301	Bladen	13.17	T. S.	100,860.00	2-20-23	J. F. Mulligan—Powell Paving and Constr. Co.
311	Brunswick	0.5	Graded	5,400.00	3-22	C. R Wise.
312	Brunswick	9.77	P. C.	373,560.00	11-23-23	Alabama Con. Prod. Co.—Batson-Cooke Co.
313	Brunswick	3.44	A. C.	112,030.00	1-11-23	Sou. Willite Paving Co.—Roanoke Br. Works.
314	Brunswick	15.82	S. C.	116,720.00	11-23-23	Hagedorn Construction Co.
316	Brunswick	12.12	S. C.	84,640.00	10-29-24	B. Frank Price—Batson-Cooke Co.
317	Brunswick		Bridge	18,340.00	6—2-23	Atlantic Bridge Co.
325	Columbus	11.22	T. S.	136,570.00	7-14-23	J. A. Kreis—Cornell & Young & Co.
326	Columbus	13.61	S. C.	241,400.00	10-13-24	J. T. Plott—J. A. Kreis & Co.
327	Columbus	5.20	S. C.	61,620.00	6-13-22	J. A. Kries.
328	Columbus	7.03	P. C.	220,900.00	10—9-23	L. L. Tindall.
329	Columbus	12.89	P. C.	401,510.00	11-21-24	Jas. O. Hayworth.
338	Cumb.-Sampson		Bridge	14,655.00	9-26-22	Roanoke Bridge & Iron Works.
339	Harnett-Comb.	7.54	T. S.	10,535.00	8-31-22	Porter & Boyd.
341	Cumb-Hoke	.2	Graded	1,050.00	2-28-22	W. B. Covington.
342	Cumberland	5.91	A. C.	183,970.00	4—7-24	A. J. Wardrep.
351	New Hanover	10.64	A. C.	243,560.00	3-10-24	Norfolk Equipment Co.
363	Onslow	15.24	T. S.	250,990.00	7—9-24	Newell Const. Co.-Pittsburg-Des Moines Steel Co.
364A	Onslow	12.84	S. C.	53,770.00	4—7-23	R. E. Martin.
346B	Onslow	12.84	T. S.	108,130.00	8—8-24	A. W. McClay.
375	Pender	15.56	S. C.	65,440.00	11-21-22	A. W. McClay.
376	Pender	7.64	Graded	107,820.00	3—5-23	C. G. Kershaw-Cornell-Young Co.
377	Pender	1.61	Graded	75,560.00	4-30-23	R. E. Martin—Hazell Connerate-Quist Co.
378	Pender	14.12	W.B. Mac.	272,040.00	6-18-24	C. W. Lacy.
379	Pender	10.50	S. A.	107,660.00	4-20-23	State Forces.
382	Pender	5.60	S. A.	75,000.00	4-30-24	State Forces.
388	Robeson	3.35	R. C.	134,100.00	9-28-22	C. W. Lacy—Roanoke Bridge & Iron Co.
389	Robeson-Columbus	1.56	S. C.	83,460.00	3-10-24	L. A. Chitwood.
391A	Robeson	1.00	S. A.	45,420.00	11-21-23	R. G. Lassiter & Co.
391B	Robeson	1.10	T. S.	19,630.00	4-26-24	H. M. Beasley.
392	Robeson	1.06	T. S.	50,780.00	12-14-23	Robeson County Com.—E. T. Gwathmey:
400	Chatham		Bridge	66,440.00	5-18-23	R. M. Walker & Co.
400A	Chatham	0.39	Grading	7,920.00	8-27-23	C. B. Hester.
408	Durham	.47	S. A.	16,090.00	9-20-23	Murray Construction Co.
409	Durham	0.5	Graded	5,410.00	8—7-22	J. P. Dicus.
410	Durham	2.3	R. C.	81,220.00	9-28-22	C. D. Riggsbee.
411	Durham	5.81	P. C.	218,590.00	7-12-23	Hutton Engineering and Construction Co.
419	Franklin	12.82	T. S.	71,380.00	7-31-23	Jamison & Brother—J. A. Marrow.
420	Franklin	1.56	R. C.	54,550.00	5-29-23	Chandler & Ragland.
427	Granville	5.12	A. C.	175,670.00	1—4-23	R. G. Lassiter & Co.
428	Granville	4.19	R. C.	142,640.00	10—1-23	Pittman Construction Co.
436	Harnett	21.91	Gravel	206,610.00	1-15-23	C. G. Kershaw Constr. Co.—Hobbs & Kitchin.
445	Lee	5.91	T. S.	24,330.00	1-15-23	C. B. Hester.
446	Lee	5.05	A. C.	200,610.00	1-15-24	Atlantic Bitulithic Co.—O. A. Mann.
453	Orange		Bridge	46,810.00	1—9-23	Geo. W. Kane.
454	Orange	4.28	P. C.	186,340.00	3—6-22	Elliott, Sholes & Teer.
455	Orange	4.19	T. S.	55,640.00	9-28-22	J. F. Mulligan Constr. Co.—P. R. Ashby.
456	Orange	9.81	Graded	51,970.00	10-25-23	Crawford & Crawford—Nello Teer.
457A	Orange	7.45	Graded	85,460.00	2-22-24	Dicus Bros.—Richards Bros.
460	Orange	9.87	A. C.	296,840.00	12-21-23	R. M. Hudson & Co.
472A	Vance	1.01	Conc.	30,740.00	12-21-23	R. G. Lassiter & Co.
473 {F A	Vance	7.83	P. C.	265,570.00	1-21-23	R. G. Lassiter & Co.
481 {146	Wake	7.40	A. C.	287,690.00	7-30-23	Union Paving Co.—P. R. Ashby.
482	Wake	6.64	A. C.	184,710.00	9-23-22	R. M. Hudson Co.
483	Wake	0.54	R. C.	19,580.00	8—7-22	C. D. Riggsbee.
484	Wake	8.79	P. C.	311,630.00	10-29-24	P. R. Ashby—Booz-Boyd Co.
484B			Bridge	13,120.00	10-29-24	Booz-Boyd Co.
485C	Wake	0.50	Grade	10,710.00	7-31-23	Booz-Boyd—Nello Teer.
492	Warren	4.48	Bit. Mac.	122,470.00	11—9-23	Porter & Peck—A. C. House.
494	Warren	6.21	A. C.	208,130.00	5-13-24	Clifford Engineering Co.
500	Alamance	5.22	Graded	36,880.00	1-17-22	W. W. Tuck & Son—A. M. Hazzell, Connerate-Quist Construction Co.
501	Alamance	13.1	T. S.	36,230.00	2-28-23	W. M. Shook-Hanford Bros.
502	Alamance	17.43	T. S.	158,990.00	9-13-23	W. E. Graham—Hanford Brothers.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed (Continued)

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
503	Alamance		Bridge	$ 74,710.00	7-20-23	Atlantic Bridge Co.
504	Alamance	5.22	A. C.	148,120.00	5—3-23	Elliot & Sholes.
505	Alamance	0.42	S. A.	15,240.00	6-23-22	Hedrick Construction Co.
506A	Alamance	0.32	Grade	11,800.00	8-11-23	Nello Teer.
506B	Alamance	.03	P. C.	12,120.00	1-12-24	W. B. Kiker.
507	Alamance	4.03	P. C.	138,950.00	6—3-24	Zeigler & Dalton.
511	Caswell	14.85	T. S.	98,830.00	5-24-24	White & Simpson.
512	Caswell	11.67	T. S.	58,150.00	11-14-23	J. T. Plott.
524	Davidson	0.3	S. A.	10,200.00	1-20-22	Town of Lexington.
525	Davidson	10.24	A. C.	363,290.00	9—4-23	Elliot & Sons & Boggs—Austin Bros. Bridge Co.
525A	Davidson	.5	S. A.	16,420.00	6-27-21	Town of Lexington.
526	Davidson	3.77	P. C.	131,820.00	10-25-22	Hagedorn Constr. Co.—Heilig & Sherrill.
528	Davidson	10.24	P. C.	440,340.00	7-25-24	Hagedorn Construction Co.—J. A. Peterson.
532	Guilford	11.54	A. C.	391,630.00	6-27-23	Elliott-Sholes Co.
532B	Guilford		Bridges	27,490.00	10—8-23	L. M. Lowdermilk.
532C	Guilford	.5	P. C.	13,180.00	4-25-23	W. B. Kiker.
533	Guilford-Forsyth	10.59	P. C.	449,340.00	7-23-23	Royer-Ferguson Construction Co.
536	Guilford	5.15	P. C.	192,120.00	11—7-24	Hagedorn Construction Co.
537A	Guilford	6.20	Graded	46,000.00	6—2-24	J. M. Gregory.
538	Guilford		Bridge	11,310.00	2-21-23	J. L. Brinkley.
539	Guilford	0.64	S. A.	23,400.00	1-19-23	Robt. G. Lassiter & Co.
540	Guilford	18.00	Recon.	16,330.00	1-23-22	J. T. Plott.
541	Guilford	4.31	Bit. Mac.	130,780.00	8-21-24	Hagedorn Construction Co.
544	Hoke	10.45	S. C.	40,610.00	5—3-23	O. A. Mann & Co.—Chitwood & Carpenter.
545	Hoke	9.15	T. S.	60,330.00	7—7-23	O. A. Mann & Co.—A. W. McClay.
546	Hoke	0.84	S. A.	15,950.00	5-30-23	Dawkins Construction Co.
555	Montgomery	20.55	T. S.	125,630.00	7-19-24	Mayfield Construction Co.—F. P. Holder.
556B	Montgomery	3.28	T. S.	19,220.00	7-28-24	J. F. Mulligan Construction Co.
557	Montgomery	2.01	A. C.	69,500.00	10-14-24	Wm. F. Bowe, Jr.
566	Moore	7.14	T. S.	72,150.00	6-30-23	Gibson Construction Co.—Nello Teer.
567	Moore	2.96	T. S.	10,820.00	9-18-22	C. E. Teague.
569	Moore	18.97	S. C.	107,070.00	10-28-23	Mayfield Construction Co.
571	Moore	4.94	S. A.	89,850.00	7-26-24	Wesco Construction Co.
577	Randolph	13.36	Conc.	423,250.00	2-14-24	Royer-Ferguson Co.—J. L. Brinkley.
578	Randolph	7.51	P. C.	312,660.00	10—3-24	Allpart Construction Co.
583	Randolph	0.75	T. S.	3,680.00	2-24-24	Nello L. Teer.
589	Rockingham	9.81	P. C.	437,890.00	11-10-24	Cheatwood & Driscoll—Atlantic Bridge Co.
590	Rockingham	3.10	Conc.	98,370.00	2—7-24	George R. Martin.
593	Rock'gham-Caswell	17.98	P. C.	511,670.00	8-18-23	J. A. Kreis.
600	Alexander	9.30	Graded	17,760.00	4-14-23	Bolton Construction Co.
601	Alexander	3.07	T. S.	36,590.00	3-31-23	Guss Ginn-R. M. Thurmond.
602	Alexander	9.28	Bit. Mac.	189,330.00	11-15-23	W. E. Graham.
606	Stanly-Anson		Bridge	61,640.00	6—6-23	Concrete Steel Bridge Co.
607	Anson	6.93	T. S.	48,940.00	5-17-23	Geer & Wilson—Booz-Lloyd & Co.
615	Cabarrus	3.88	A. C.	125,980.00	6—1-23	Thompson-Caldwell—Atlantic Bridge Co.
615B	Cabarrus		Graded	3,080.00	3-22-24	Lee J. Smith.
622	Catawba	10.85	A. C.	342,120.00	5-25-23	Union Paving Co.
630A	Gaston	3.02	A. C.	100,190.00	7- -22	W. F. McCanless.
630B	Gaston	6.65	A. C.	221,720.00	3—8-24	W. F. McCanless—Hobbs-Peabody Constr. Co.
630B Ext	Gaston	0.95	A. C.	36,940.00	3—8-24	W. F. McCanless.
632	Gaston	8.50	R. C.	291,450.00	1—9-24	Davis-Wilcox Construction Co.
633A	Gaston	7.67	A. C.	180,000.00	10—5-22	Gaston County.
633B	Gaston	3.86	A. C.	68,000.00	10-14-23	Gaston County.
634	Gaston	Bridge	Recon.	4,350.00	10-16-22	State Forces.
638	Iredell	7.88	A. C.	287,930.00	1-20-23	Thompson-Caldwell Co.
639	Iredell	10.59	A. C.	428,120.00	1-20-23	R. M. Hudson Co.—Luten Bridge Co.
651	Meck-Gaston		Bridge	4,780.00		State Forces.
652	Mecklenburg		Bridge	1,930.00	10-30-22	State Forces.
653	Mecklenburg	8.84	A. C.	304,250.00	1-25-24	Union Paving Co.—Luten Bridge Co.
654	Mecklenburg	10.10	A. C.	308,280.00	12—4-23	Lampton & Burks.
655	Mecklenburg	1.57	P. C.	67,180.00	7-31-22	Speed-Parker Co., Inc.—Luten Bridge Co.
656	Mecklenburg	10.4	Bit. Mac.	6,300.00	10-30-22	State Forces.
657	Mecklenburg	13.80	Recon.	16,560.00	10-30-22	State Forces.
659A	Mecklenburg		Bridge	7,420.00	9-29-23	Luten Bridge Co.
661	Richmond	9.76	T. S.	45,100.00	4-17-24	McDonald & Brooks.
665	Richmond	5.77	A. C.	201,830.00	10—9-23	A. J. Wardrep.
670	Rowan	4.53	Conc.	142,220.00	11-15-23	Harris Construction Co.
673	Davidson-Rowan	.59	Bridge	225,650.00	8-15-24	Hardaway Constr. Co.—Elliot & Sons.
691	Union		Bridge	15,940.00	10-31-23	J. L. Brinkley.
692	Union	2.28	A. C.	71,940.00	12-28-21	Redmon Construction Co.
693	Union	1.14	T. S.	6,080.00	2-23-23	Sykes-Collins Co.
694	Union		Bridge	23,620.00	9-24-23	Hagedorn Construction Co.
695	Union	4.51	A. C.	138,860.00	9-14-22	Redmon Construction Co.
696	Union	6.04	A. C.	187,560.00	12—8-23	Redmon Construction Co.
700	Alleghany	7.90	W. B. Mac.	154,000.00	11-14-23	W. E. Graham.
701	Alleghany-Wilkes	8.00	Bit. Mac.	201,300.00	5-13-24	W. E. Graham.
703 {FA 125A	Alleghany	4.99	Bit. Mac.	27,520.00	1—4-24	State Forces.
710	Ashe	3.14	P. C.	144,590.00	8-17-24	Pittman Construction Co.
711	Ashe	6.50	Gravel	66,000.00	11—8-24	Little Contracting Co.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed (*Continued*)

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
713	Ashe	3.53	P. C.	$ 145,780.00	8-14-24	Overstreet & Nance—Concrete Steel Bridge Co.
719	Caldwell	--------	Bridge	4,980.00	9-19-22	Cottrell & Howard.
719B	Caldwell	.99	Gravel	3,550.00	11-15-22	J. G. Bumgardner.
722	Caldwell	7.40	Recon.	19,660.00	1-18-22	County Forces.
723A	Caldwell	2.10	Gravel	40,000.00	8-22-21	Purchased.
724	Caldwell	4.66	T. S.	68,900.00	7-24-23	County Forces—R. M. Thurmond & Co.
725	Caldwell	4.00	Recon.	28,380.00	2-24-23	County Commissioners.
726	Caldwell	11.00	Graded	80,000.00	4-28-24	State Forces.
726A	Caldwell	11.00	Gravel	60,500.00	4-10-24	J. F. Mulligan Construction Co.
731	Davie	5.46	P. C.	200,750.00	7-21-23	G. R. Martin—Heilig & Sherrill.
732A	Davie	8.07	Grade	35,480.00	11-12-24	J. F. Mulligan Construction Co.
732B	Davie	8.07	P. C.	311,030.00	10-29-24	Hardaway Construction Co.
741	Forsyth	8.90	Conc.	321,930.00	3-19-24	Hardaway Construction Co.
742	Forsyth	10.62	R. C.	413,070.00	6-11-24	Harris Construction Co.
743	Forsyth	11.35	A. C.	414,670.00	8-12-24	Atlantic Bithulitic Co.
742	Forsyth	2.00	T. S.	15,000.00	2-22-23	Forsyth County.
750A	Stokes	14.86	T. S.	91,820.00	3-26-24	J. F. Mulligan.
751	Stokes	7.16	T. S.	35,340.00	8-26-22	W. E. Graham.
752	Stokes	9.67	T. S.	148,500.00	7-26-24	W. E. Graham.
760	Surry-Alleghany	6.9	T. S.	31,450.00	11—5-22	W. E. Graham.
761	Surry	2.22	P. C.	82,070.00	10-27-23	Geo. R. Martin.
764	Surry	1.63	R. C.	50,300.00	2—4-23	Leaksville Lumber Co.
765	Surry	3.39	Conc.	123,750.00	3-26-24	Campbell Construction Co.
770A	Watauga	3.00	Bit. Mac.	72,600.00	9-16-24	State Forces.
771B	Watauga	13.50	Gravel	46,200.00	9-16-24	State Forces.
782	Wilkes	5.97	R. C.	207,970.00	8—4-23	Hyde & Baxter.
783	Wilkes-Watauga	36.00	Gravel	175,000.00	9-30-23	Chandler & Ragland.
784	Wilkes	4.97	T. S.	90,200.00	1-12-24	J. F. Mulligan Constr. Co.—Foster Constr. Co.
785	Wilkes	2.52	P. C.	76,120.00	10—1-23	J. D. Brookshire & Co.
791	Yadkin	13.40	Grade	127,960.00	10-31-24	W. E. Graham—Luten Bridge Co.
800	Avery	5.84	R. C.	199,120.00	8-28-24	O'Brien Construction Co.—J. A. Kreis.
801	Avery	.99	W. B. Mac.	28,810.00	10-26-22	Geer & Wilson.
811	Burke	5.24	P. C.	180,460.00	10-30-23	Southern Dray Co.
811B	Burke	--------	Bridge	18,150.00	3-19-24	R. W. Curtis.
813	Burke	--------	Bridge	3,700.00	8-11-24	R. W. Curtis.
814	Burke	8.69	S. C.	35,660.00	4-25-23	M. A. Kollock.
815	Burke-Cleveland-Lincoln	11.63	T. S.	127,020.00	6-17-24	Geer & Wilson—J. L. Van Glahn.
821	Cleveland	1.58	P. C.	60,190.00	4—4-24	Davis-Wilcox Construction Co.
822	Cleveland	10.47	A. C.	408,180.00	9—4-24	Elliott & Sons—J. A. Kreis & Co.
823	Cleveland	1.90	P. C.	80,440.00	8-15-22	Southern Paving Co.—Z. B. Weathers & Son.
833	Henderson	5.20	Gravel	61,170.00	10-26-23	S. L. Davis Constr. Co.—Asheville Constr. Co.
837	Henderson	5.83	W. B. Mac.	70,000.00	9-16-23	Dixon Construction Co.
837B	Henderson	5.83	A. C.	74,370.00	10-20-23	Dixon Construction Co.
844	McDowell	1.8	P. C.	61,510.00	12-13-21	Bolton Construction Co.
845	McDowell	7.19	Gravel	184,850.00	12-22-22	J. W. Stapp Constr. Co.-Praytor, Howton & Wood.
846	McDowell	10.06	Gravel	284,980.00	6-19-24	Asheville Constr. Co.—W. T. Taylor Constr. Co.
846A	McDowell	.73	Graded	28,420.00	6-19-24	Asheville Construction Co.
848	McDowell	--------	Bridge	31,130.00	10-23-23	R. M. Thurmond & Co.
855	Mitchell	4.97	P. C.	253,100.00	4-17-23	Fisk-Carter Construction Co.
855B	Mitchell	--------	Bridge	9,310.00	8-22-22	Luten Bridge Co.
856	Mitchell	6.88	Bit. Mac.	283,170.00	11-20-24	Porter & Boyd—L. J. Chandler.
858	Mitchell	--------	Bridge	49,500.00	6-17-24	R. M. Thurmond & Co.
866	Polk	5.96	Bit. Mac.	196,530.00	10-30-23	Southern Paving Co.—Henry Constr. Co.
875	Rutherford	--------	Bridge	1,980.00	7-18-22	Geer & Wilson.
876 {F A 78B	Rutherford	4.80	P. C.	150,490.00	8-23-23	Fisk Carter Construction Co.
877	Rutherford	9.79	T. S.	106,370.00	8—7-22	Geer & Wilson.
878	Rutherford	6.55	T. S.	73,030.00	10-27-22	Micheaux Constr. Co.—Geer & Wilson.
879	Rutherford	--------	Bridge	6,870.00	6-21-22	Austin Bros. Bridge Co.
880	Rutherford	--------	Bridge	30,880.00	3-23-23	Austin Bros. Bridge Co.
882	Rutherford	15.80	T. S.	166,420.00	9—2-24	C. R. Willard & Sons.
882B	Rutherford	--------	Bridge	12,370.00	10—3-23	Micheaux Constr. Co.—Lee J. Smith Constr. Co.
882D	Rutherford	--------	Bridge	12,260.00	8-13-24	Gwathmey-Saddler Co.
890	Yancey	2.48	P. C.	87,051.00	11—7-24	Fiske-Carter Construction Co.
903	Buncombe	2.58	A. C.	105,300.00	6-23-23	Asheville Paving Co.—R. C. Stevens.
904	Buncombe	1.60	A. C.	77,750.00	6-23-23	Asheville Paving Co.—R. C. Stevens.
910	Cherokee	7.56	Gravel	146,440.00	1—1-23	Ross Bros. Constr. Co.-W. T. Moore Conc. Prod. Co
911	Cherokee	10.33	Gravel	92,590.00	5-15-23	H. A. Wills—Southern Dray Co.
920	Clay	5.01	Gravel	70,810.00	6-21-23	E. A. Wilson & Co.—W. T. Moore Conc. Products Co.
921	Clay	12.37	Gravel	198,680.00	10-26-23	L. J. Smith Constr. Co.—W. T. Moore Conc. Products Co.
930	Graham	12.90	T. S.	222,400.00	11-10-23	Lee J. Smith Construction Co.—C. M. Dicus.
930A	Graham	2.92	Gravel	25,340.00	11-26-23	C. M. Dicus.
942	Haywood	.57	Gravel	6,490.00	2—1-22	O'Brien Construction Co.
943	Haywood	12.7	Gravel	14,710.00	5-18-23	State Forces.
950	Jackson	7.56	Gravel	241,340.00	6-16-24	Wright & Nave—O'Brien Constr. Co.
954	Jackson	1.68	P. C.	93,500.00	9-24-23	Mills-Williams Construction Co.
960	Macon	4.97	S. C.	81,990.00	12-31-22	J. T. Plott—J. E. Lane & Co.
961	Macon	4.77	T. S.	72,271.00	6—1-23	J. T. Plott—J. E. Lane & Co.
970	Madison-Yancey	23.98	Gravel	274,000.00	------------	R. H. Wright & Sons—O'Brien Constr. Co.

PROJECTS UNDER CONTRACT

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	CONTRACTOR
111 117	Camden-Currituck	--------	Bridge	$ 17,753.00	Gwathmey-Saddler Co.
212	Craven	10.76	Grading	117,476.00	Eagle Engineering Co.—Pittsburg-Des Moines Steel Co.
237B	Johnston	.51	S. A.	15,262.00	C. D. Riggsbee.
318	Brunswick	8.13	S. A.	98,221.00	W. F. Bowe, Jr.
352	New Hanover-Brunswick	2.31	W. B. Mac.	53,010.00	Highway Engineering and Construction Co.
404C	Chatham	--------	Bridge	68,400.00	Atlantic Bridge Co.
415	Durham	8.01	Grading	136,553.00	B. F. Teeter—J. A. Peterson.
421B	Franklin	8.23	P. C.	283,160.00	Robt. G. Lassiter & Co.
422	Franklin	4.29	Grading	56,681.00	J. M. Gregory—Kewhn-Englehard & Thorne.
432	Granville	6.48	Grading	60,886.00	T. W. Chandler.
433	Granville	13.73	Grade	113,748.00	W. W. Tuck & Son—E. A. Wood & Co.
570B	Moore	--------	Bridge	17,137.00	Atlantic Bridge Co.
610	Anson-Richmond	--------	Bridge	290,000.00	Hardaway Contracting Co.
686B	Stanly	12.00	A. C.	414,810.00	Noll Construction Co.
763B	Surry	10.54	P. C.	323,309.00	Zeigler & Dalton.
835	Henderson	6.82	W. B. Mac.	281,170.00	C. M. Dicus.
912	Cherokee	--------	Bridges	93,670.00	W. T. Moore.
912A	Cherokee	8.62	Graded	89,110.00	Wilson Construction Co.
912B	Cherokee	8.35	Graded	36,280.00	W. T. Moore.
981	Swain	6.12	W. B. Mac.	114,588.00	Asheville Construction Co.
990A	Transylvania	.47	W. B. Mac.	13,460.00	Piedmont Construction Co.
992	Transylvania	1.57	Graded	49,980.00	W. H. Anderson Construction Co.—R. C. Stevens.

Summary

WORK UNDER CONTRACT

TYPE	STATE		FEDERAL AID	
	Length	Cost	Length	Cost
P. C.	23.77	$ 606,469.00		
A. C.	12.00	414,810.00		
S. A.	8.64	113,483.00		
W. B. Mac.	15.72	462,228.00		
Graded	69.08	697,018.00		
Bridges	--------	486,960.00		
Total	131.29	$ 2,780,968.00		

WORK UNDER CONSTRUCTION

TYPE	STATE		FEDERAL AID	
	Length	Cost	Length	Cost
S. A.	88.99	$ 1,617,420.00		
P. C.	320.44	10,653,877.00		
R. C.	15.20	505,970.00		
A. C.	76.74	2,623,063.00		
Bit. Mac.	22.30	535,160.00		
W. B. Mac.	99.11	1,746,590.00		
T. S.	266.85	2,087,490.00		
S. C.	15.86	219,170.00		
Graded	262.61	3,347,223.00		
Gravel	153.47	1,809,072.00		
Recon.	14.50	254,000.00		
Bridges	--------	1,144,560.00		
Total	1,336.07	$ 26,543,595.00		

Summary—Continued

WORK COMPLETED

Type	State Length	State Cost	Federal Aid Length	Federal Aid Cost
R. C.	201.94	$ 7,083,350.00	25.56	$ 889,940.67
P. C.	135.37	5,007,781.00		
A. C.	341.06	10,757,230.00	42.29	1,521,368.25
S. A.	25.76	445,610.00	22.91	763,048.82
Bit. Mac.	57.30	1,230,000.00	34.82	804,336.77
S. C.	213.58	1,694,470.00	83.90	785,198.22
W. B. Mac.	28.84	524,850.00	28.39	769,653.07
T. S.	366.60	3,260,146.00	509.18	5,228,132.54
Gravel	213.59	1,925,490.00	42.56	488,699.18
Graded	234.67	2,025,630.00	31.41	487,267.56
Brick	9.50	233,480.00		
Sheet Piles		14,180.00		
Cord	2.40	70,950.00		
Recon.	60.95	228,600.00		
Bridges		936,985.00		651,051.10
Total	1,891.56	$ 35,438,752.00	821.02	$ 12,388,696.18

Total Roadway Mileage 4,279.94. Total estimated cost of Roadway $77,152,011.18.
Total estimated cost of Bridges $3,219,556.10. Corrected to Dec. 1st, 1924.

LEGEND

P. C.—*Plain Concrete. R. C.—*Reinforced Concrete. A. C.—*Asphaltic Concrete. S. A.—*Sheet Asphalt. Bit. Mac.—*Bit minous Macadam. W. B. Mac.—*Water Bound Macadam. T. S.—†Top Soil. S. C.—†Sand Clay. Gravel—†Gravel. Graded—†Graded. Recon.—†Reconstruction. Cord.—†Corduroy.

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* Hard Surface. † "G" Type.

Development of Sand Asphalt *in* N. C.

(*Continued from page 12*)

sand. It is prepared at the plant, in the same manner as the base course and should arrive on the road between the temperature of 300 to 350 degrees F. Prior to spreading the wearing surface mixture, the surface of the base should be swept clean, and an effort should be made to keep the base clean at all times, and no more base is allowed to be laid than can be covered in a day's run of top. This is done to assist in keeping the base free from dirt so that a bond will be secured between the base and top courses.

Laying Sand Asphalt Base Course

The wearing surface is dumped on the steel dumping board and is spread and raked in similar manner as the base course. The mixture is laid sufficiently thick to produce 1½″ compressed pavement after rolling. The depth of the loose mixture is gauged by raking the surface to conform to a template. The same weight roller is used, as on base, and after the wearing surface has been rolled longitudinally, it is subjected to diagonal rolling in two directions. The surface is checked for smoothness by a 10 foot straight edge. After final rolling and while the pavement is still warm, a uniform coating of limestone dust or Portland is broomed on the surface and rolled in. The average density of the wearing surface ranges from 2.10 to 2.20.

The average bid price of this type of pavement ranges from $1.45 to $2.00 per square yard.

The Sand Asphalt pavement properly constructed on a uniform, well drained subgrade will carry an unlimited volume of passenger car traffic and light pneumatic-tired trucks. It is ideal for this class of traffic. If in the future, the volume of solid-tired, heavy truck traffic becomes large on any of these roads, then it will be economy to build higher types of pavement, or perhaps salvage the existing sand asphalt pavement by increasing its thickness by the addition of 1½ or 2″ of hot mix, but in the meantime, the Sand Asphalt pavement as now laid, will have rendered many years of service at a low cost. This pavement has great possibilities of development wherever unlimited local sand is available. Climatic conditions suitable, traffic comparatively light, and a firm uniform well drained subgrade can be obtained.

The Success on Highway Work is Well Merited

On highway work, the use of one P & H Shovel has invariably led to the addition of another and another. This has been the case in a half dozen instances—because as one chief construction engineer says—"while we have used other makes of shovels on our various projects, none has given the same efficient service that we are getting from the P & H Shovels. They average considerably highly daily output, and delays and repair expenses are negligible."

The outstanding superiority of the P & H wherever comparisons are made is well known. Being pioneers in the development of the successful gasoline excavator, has given us experience that can be gained in no other way. The quality of design and workmanship and the selection of materials used are given still greater attention today; —all contributing to longer life, lower maintenance, and greater production.

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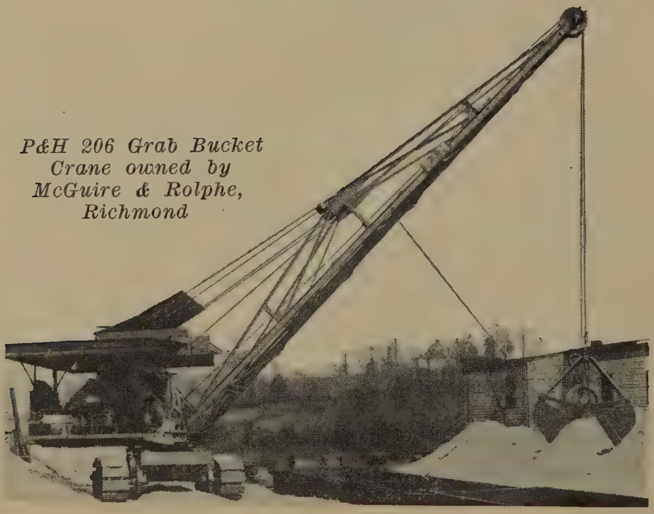

P&H 206 Grab Bucket Crane owned by McGuire & Rolphe, Richmond

P&H GASOLINE SHOVEL

State Police *and* Highway Patrols

(*Continued from page 7*)

In 365 days 344 automobiles were recovered, nearly one a day. The result of training is responsible for 14,166 arrests in 1923, of which 91 per cent were convicted, 3 per cent discharged, and 6 per cent still pending. In addition to these, 13,992 cases were investigated in which no arrests were made. This surely argues strongly in favor of the fine judgment of the officers.

In most organizations the men have had previous military service, which is a wonderful aid in the disciplining of the officers.

The duties of the state officer consists of checking and preventing crime, and the apprehension of criminals, which is done in a straight-forward, dignified, courteous manner.

With the need proven, the effectiveness acknowledged, and the expense nil—why not have protection in North Carolina?

Road Show More Popular Than Ever

(*Continued from page 9*)

situation, are coöperating with the committee in charge by curtailing their exhibits and at the same time presenting the machines and products which they know will be of the most interest to the throngs of contractors who will attend the Show.

The A. R. B. A. convention, which will be held simultaneously with the Road Show, will again be at the Congress Hotel. The program, which has been prepared by Prof. T. R. Agg, contains a long list of subjects which are of vital interest to every one engaged in road construction. The contractor, the engineer, the public official and all others active in the highway industry will find the papers and discussions of great interest. The detailed program will be announced shortly.

Arrangements have been made this year to handle hotel reservations in such a manner that every one will be roperly cared for. A special hotel committee has prepared a booklet giving a list of Chicago hotels with their rates and containing a reservation blank. This booklet will be sent to anyone who wishes it.

The Entertainment Committee is planning to take good care of the time not already allotted to the sessions of the Convention and the Road Show. The delegates and guests of the Association will find plenty to do every minute while they are in Chicago. The Annual Banquet of the A. R. B. A. will be held at the Congress Hotel on Wednesday evening, Jan. 7. A dance at the Club Chez Pierre and the usual exhibitors' night in the First Regiment Armory, near the Coliseum, also are on the entertainment program.

Those who attend the Convention and Road Show will be able to keep in touch with what is going on through the **Highwayman**, the official A. R. B. A. paper, which will be issued daily, as in the last two years. The official announcements, the program of the day and various other matters of interest will be published in the **Highwayman.**

C. M. Upham, Business Director of the Association, will open headquarters at the Congress Hotel on Dec. 1.

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Conforming to the specifications of the North Carolina State Highway Commission

Prompt shipments by rail or water

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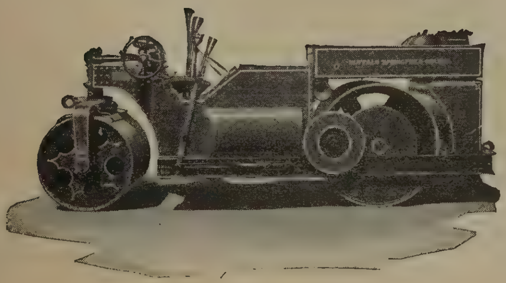

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Obtainable in all weights and types—either steam or motor propelled.

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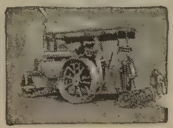
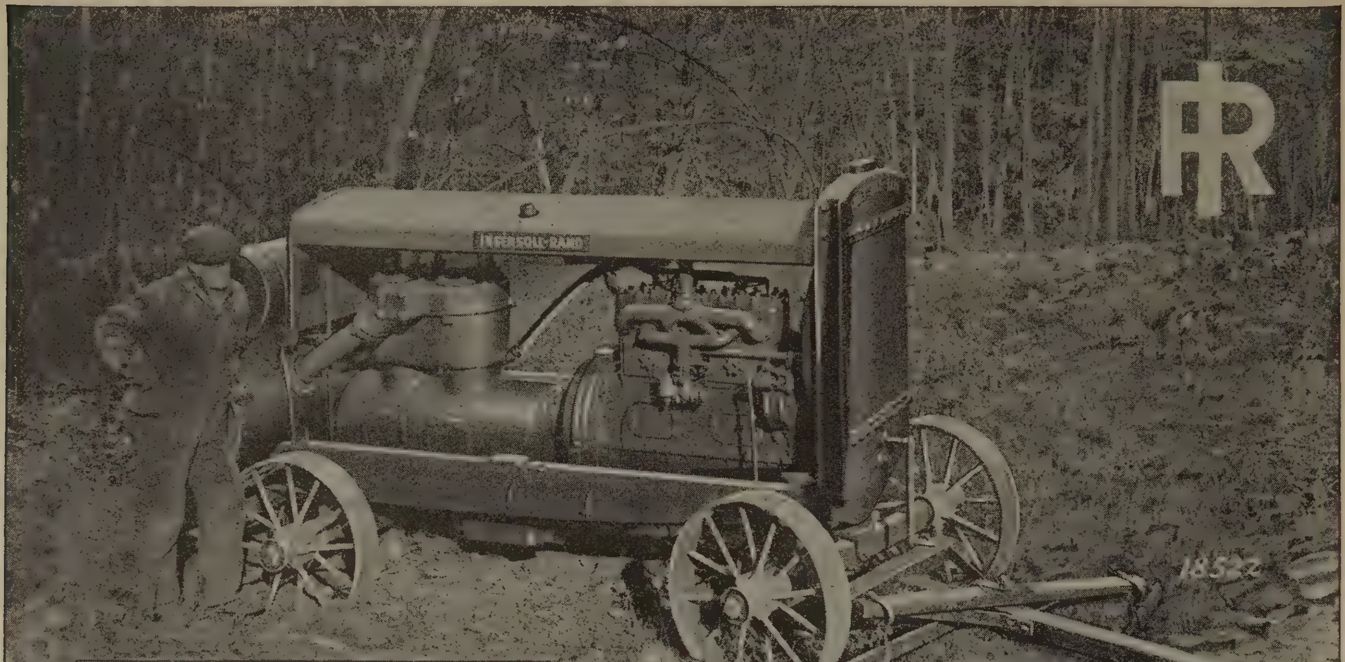
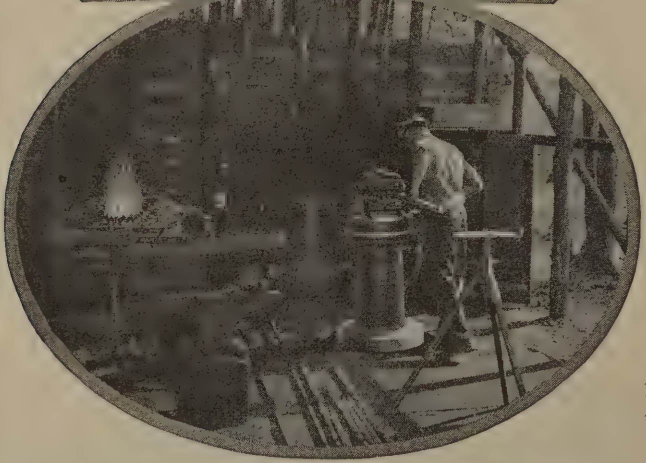


North Carolina Agent E. F. CRAVEN Greensboro

"The Road Machinery Man"





FOR BETTER ROADS

Modern machinery — Portable Compressors "Jackhamer" Drills, Sharpeners—have revolutionized roadbuilding.

Present day, straight, wide, graded highways require the drilling of thousands of holes and the removal of hundreds of thousands of cubic yards of rock. These conditions are best met by tried, proven roadbuilding machinery.

Three Essentials

The three essentials to meet such modern roadbuilding conditions are—COMPRESSED AIR, DRILLS and DRILL STEEL.

The Portable Compressor is a reliable, economical source of air supply. The air is made right on the job—where it is used.

"Jackhamer" Drills are durable, efficient and easy to operate. They are equal to the most severe operation conditions and there is one to fit every drilling job.

The "Leyner" No. 33 is a "Jacksteel" Sharpener. It makes sharp, uniform, accurately gauged bits. This results in smaller gauge, less drilling and increased drilling speed. The No. 33 is light, portable and economical.

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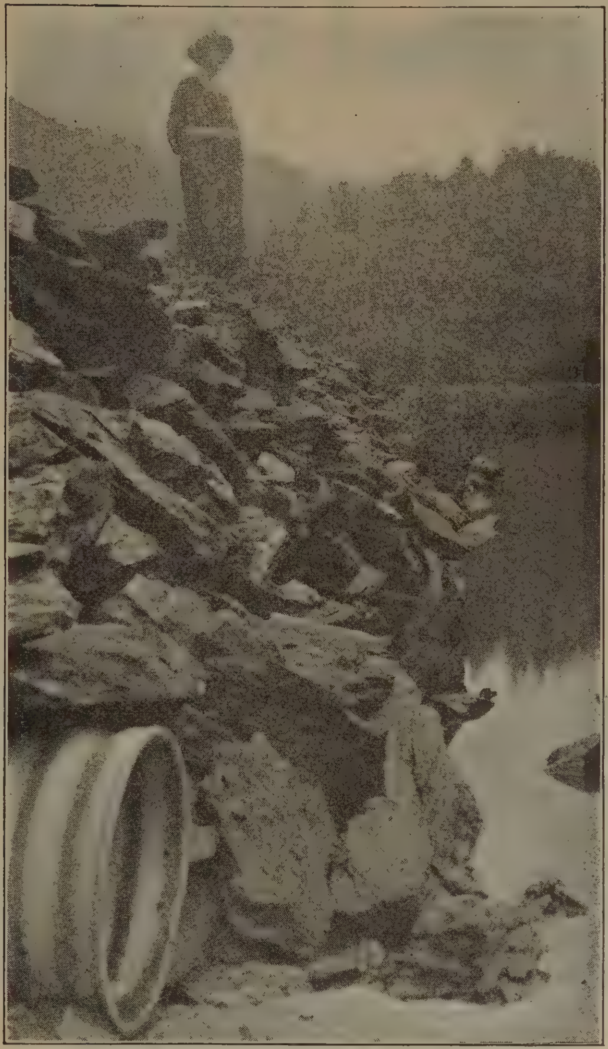

An Armco Culvert Between Lenoir and Blowing Rock, North Carolina.

The rugged strength and elasticity of this Armco Culvert enable it to hold up tons of rock on this mountain road above the clouds.

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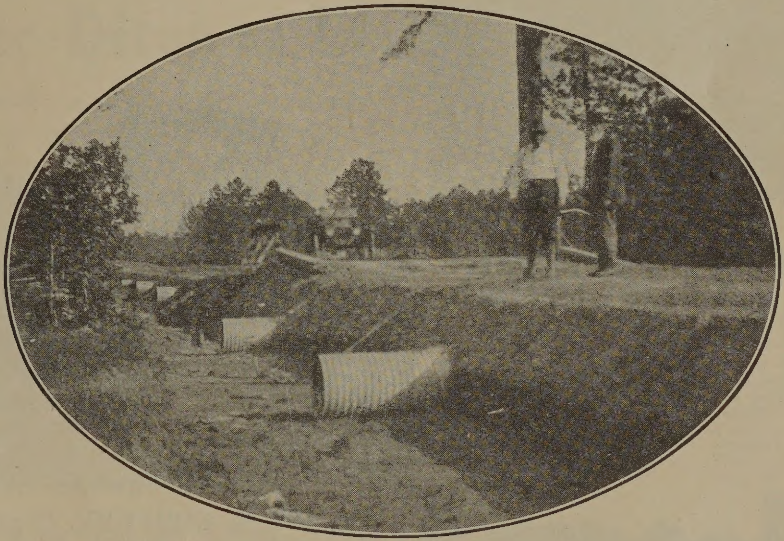

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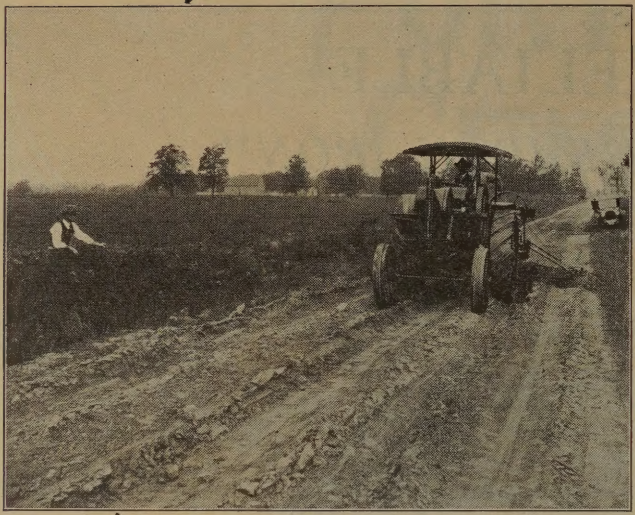

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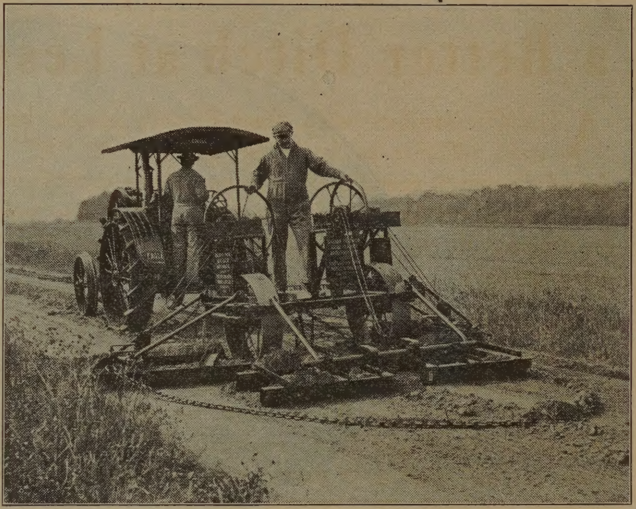

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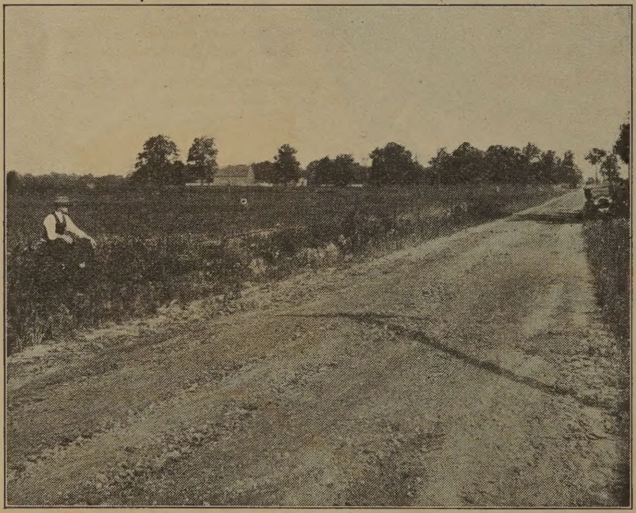

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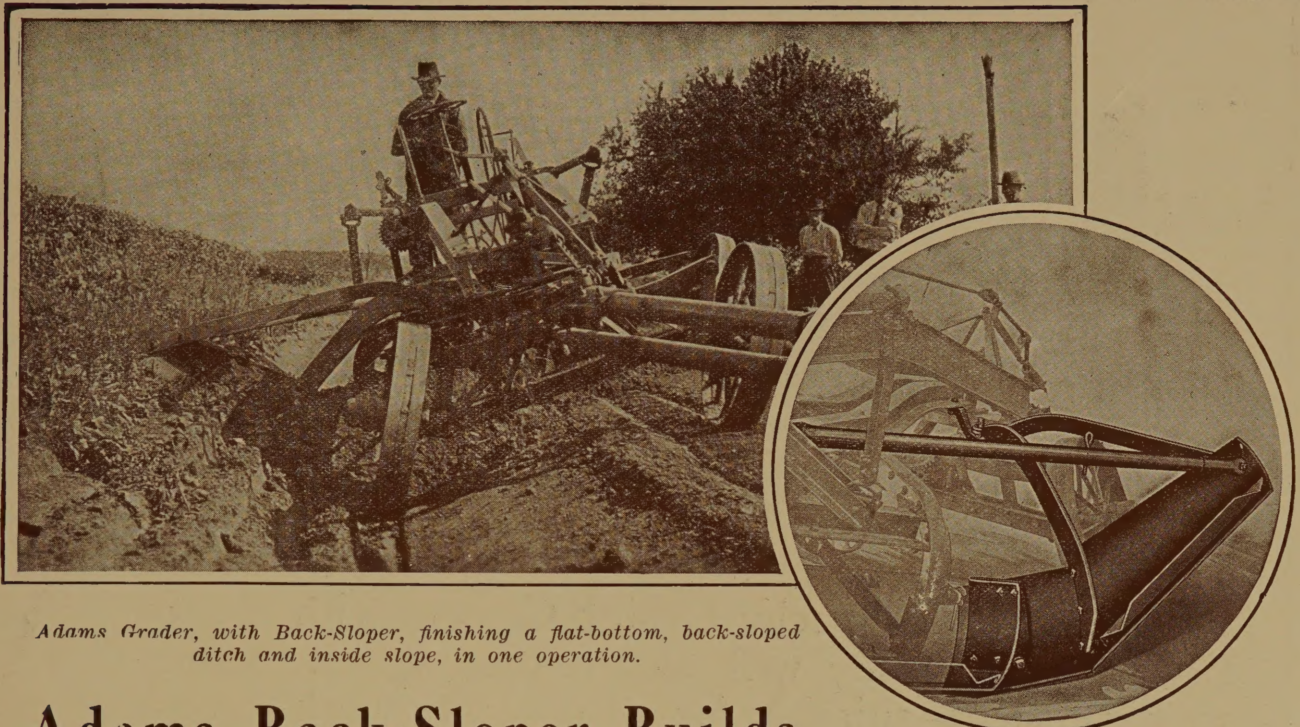

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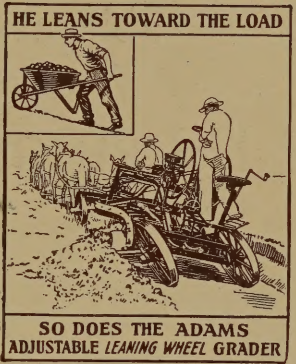
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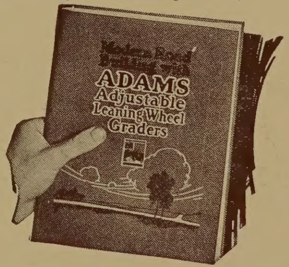

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